

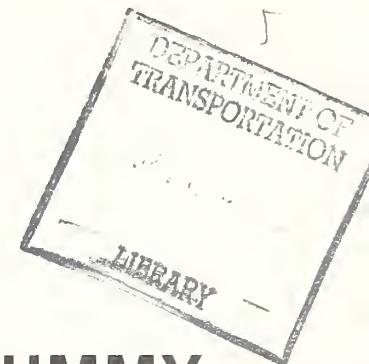
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U.S. Department
of Transportation
National Highway
Traffic Safety
Administration

DOT HS 807 660
Final Report

July 1990



EVALUATION OF THE BIOSID DUMMY MDB-To-Car Side Impact Test of a 26° Crabbed Moving Deformable Barrier into a 1987 Chevrolet Cavalier 4-door sedan at 33.5 MPH

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TRANSPORTATION

Technical Report Documentation Page

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15. Supplementary Notes This test was conducted as part of VRTC Project No. VRTC-89-0138 Evaluation of the BioSid Dummy			
16. Abstract <p>This test report documents a crash test to evaluate the response of BioSid dummies in a moving deformable barrier into stationary vehicle side impact crash test. Testing was conducted on a 1987 Chevrolet Cavalier 4-door Sedan at the TRC Crash Test Facility, East Liberty, Ohio. The test vehicle was impacted on the left side by a moving deformable barrier, crabbed to 26°, at 33.5 mph. The test was a simulation of a 90° intersection collision with the striking vehicle travelling at 30 mph and the struck vehicle travelling at 15 mph. Occupant responses of two side impact dummies were measured. One dummy was located in the driver's designated seating position and one was located in the left rear seating position. The test date was June 4, 1990 and the ambient temperature was 49°F.</p>			
DRIVER	PASSENGER		
Head Injury Criteria (HIC)	182	478	
Upper Spine Acceleration, g	64	45	
Left Upper Rib Acceleration, g	99	59	
Left Center Rib Acceleration, g	98	86	
Left Lower Rib Acceleration, g	94	97	
Lower Spine Acceleration, g	61	69	
Thoracic Trauma Index (TTI)	80	93	
Pelvis Acceleration, g	109	97	
17. Key Words BioSid Dummy Occupant Response Moving barrier Crash Testing		18. Distribution Statement Available from: National Technical Information Service Springfield, Virginia 22161	
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SECTION 1.0
PURPOSE AND TEST SUMMARY

PURPOSE

The purpose of this test was to evaluate the response of BioSid dummies in a moving deformable barrier into stationary vehicle side impact test. The vehicle was tested using conditions not currently contained in a Federal Motor Vehicle Safety Standard.

INTRODUCTION

A stationary 1987 Chevrolet Cavalier 4-door sedan was impacted on the left side by a Moving Deformable Barrier (MDB) on June 4, 1990. The test was to simulate an intersection collision with the striking vehicle travelling at 30 mph and the struck vehicle travelling at 15 mph. The orientation angle of the striking vehicle was 90° counterclockwise with respect to the longitudinal axis of the struck vehicle. The leading edge of contact was to be 37 inches forward of the midpoint of the wheelbase.

To simulate this collision, the MDB was to be towed into the stationary Chevrolet Cavalier at 33.5 mph with MDB's wheels crabbed clockwise to 26°. The actual test speed was 33.5 mph and the actual leading edge of contact was 36.5 inches forward of the midpoint of the Chevrolet Cavalier's wheelbase.

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains data required by R & D. Appendix A contains pre-test and post-test vehicle and dummy photographs. Appendix B contains Data Plots. Appendix C contains Dummy Certification Data.

SECTION 2.0

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: General Motors, LTD.

MAKE/MODEL: Chevrolet Cavalier VIN: 1G1JD5116HJ260477

BODY STYLE: 4-door sedan MODEL YEAR: 1987

NHTSA NO.: NA COLOR: Black

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 2.0 Liters

TRANSMISSION DATA: 5 SPEED, X MANUAL, AUTOMATIC, X FWD, RWD, 4WD

DATE VEHICLE RECEIVED: 5/21/90 ODOMETER READING: 38,900

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	Yes	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TLTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	Yes
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	No
OTHER	None		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good

DATA FROM VEHICLE'S CERTIFICATION LABEL:

VEHICLE MANUFACTURED BY: General Motors, LTD.

DATE OF MANUFACTURE: 6/87 VIN: 1G1JD5116HJ260477

GVWR: 3350 LBS

GAWR: FRONT: 1825 LBS., REAR: 1525 LBS.

TEST VEHICLE INFORMATION CONTINUED

VEHICLE TIRE DATA:

RECOMMENDED COLD TIRE PRESSURE: FRONT 35 psi; REAR 35 psi

TIRES ON VEHICLE (MFR. & LINE, SIZE): Goodyear Ameroway XT P175/80R13 M&S

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 1

IS SPARE TIRE "SPACE SAVER"? Yes

IS SPARE TIRE STANDARD EQUIPMENT? Yes

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS):

RIGHT FRONT	761 LBS.	RIGHT REAR	406 LBS.
LEFT FRONT	797 LBS.	LEFT REAR	402 LBS.
TOTAL FRONT WEIGHT	1558 LBS.	(65.8% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	808 LBS.	(34.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	2366 LBS.		

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	RF 25.7;	LF 25.8;	RR 25.5;	LR 26.0
PRE-TEST ATTITUDE:	RF 24.6;	LF 24.6;	RR 22.8;	LR 22.9
POST-TEST ATTITUDE:	RF 24.7;	LF 23.1;	RR 22.6;	LR 22.4

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 228 LBS. CARGO:

RIGHT FRONT	878 LBS.	RIGHT REAR	566 LBS.
LEFT FRONT	878 LBS.	LEFT REAR	602 LBS.
TOTAL FRONT WEIGHT	1756 LBS.	(60.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1168 LBS.	(40.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2924 LBS.		

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 0 LBS.

TEST VEHICLE INFORMATION CONTINUED

TEST FLUID TYPE

TEST FLUID TYPE: PURPLE STODDARD SOLVENT 2; SPEC. GRAVITY: 0.764

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USABLE" CAPACITY*: NA GALLONS

TEST VOLUME: 0 GALLONS

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): NA GALLONS

DETAILS OF FUEL SYSTEM: DNA

ELECTRIC FUEL PUMP: DNA

FUEL INJECTION: DNA

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? DNA

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.:

RECOMMENDED COLD TIRE PRESSURE: FRONT 35 psi; REAR 35 psi

RECOMMENDED TIRE SIZE: P175/80R13 LOAD RANGE X B, C

NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT

3 REAR

CARGO LOAD 132 LBS. TOTAL

TOTAL 882 LBS.

*WITH ENTIRE FUEL SYSTEM FILLED WITH FUEL TANK THROUGH CARBURETOR BOWL.

VEHICLE TEST WEIGHT CALCULATION

Test Weight = Unloaded Delivered Weight +
(Number of Dummies X 165 lbs.) +
Cargo Weight*

To achieve test weight battery was removed. The fuel tank was empty. The weight of the test vehicle was measured by placing each wheel on a KJ Law Force Plate.

*A total test weight of 2940 pounds was used to duplicate a previous side impact test using a Chevrolet Cavalier.

TEST CONDITIONS

TEST NUMBER: 900604

DATE OF TEST: 6/4/90

TIME OF TEST: 1444

DRIVER DUMMY TEMPERATURE: 71° F

PASSENGER DUMMY TEMPERATURE: 71° F

AMBIENT TEMPERATURE AT IMPACT AREA: 49° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 69° F

MAX. LENGTH = 174.2 MAX. WIDTH = 66.4 TOP WIDTH = 46.5

WHEELBASE = 101.8 C.G. = 40.7 REARWARD OF FRONT WHEEL CENTERLINE

LEFT FRONT DOOR: UNLOCKED WINDOW: UP

LEFT REAR DOOR: UNLOCKED WINDOW: UP

RIGHT FRONT DOOR: UNLOCKED WINDOW: DOWN

RIGHT REAR DOOR: UNLOCKED WINDOW: DOWN

EMERGENCY BRAKE: OFF

TRANSMISSION: NEUTRAL

STEERING COLUMN: NON-ADJUSTABLE

SEAT TRACKS: MID POSITION

SEAT BACK ANGLE: 24°

TYPES OF SEATS: FRONT - BUCKET; REAR - BENCH

TIRE PRESSURE: FRONT 35 psi; REAR 35 psi

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

TEST CONDITIONS, CONTINUED

SUBJECT VEHICLE DATA

	<u>ACTUAL</u>	<u>INTENDED</u>
VEHICLE TEST WEIGHT (LBS.)	2924	2940
MDB TEST WEIGHT (LBS.)	2903	2900
MDB VELOCITY (MPH)*	33.5	33.5
IMPACT POINT (INCHES)**	36.5	37.0

DUMMY DATA

	<u>DRIVER</u>	<u>LEFT REAR PASSENGER</u>
TYPE:	BioSid	BioSid
SERIAL NO.:	001	002
INSTRUMENTATION:		
HEAD	3 accel.	3 accel.
SHOULDER	1 accel., 3 force, & 1 displ.	1 accel. & 1 displ.
UPPER SPINE	4 accel.	3 accel.
LEFT UPPER THORAX RIB	2 accel. & 1 displ.	2 accel. & 1 displ.
LEFT CENTER THORAX RIB	2 accel. & 1 displ.	2 accel. & 1 displ.
LEFT LOWER THORAX RIB	2 accel. & 1 displ.	2 accel. & 1 displ.
LOWER SPINE	4 accel.	4 accel.
LEFT UPPER ABDOMEN	1 accel. & 1 displ.	1 accel. & 1 displ.
LEFT LOWER ABDOMEN	1 accel. & 1 displ.	1 accel. & 1 displ.
PELVIS	3 accel. & 3 force	3 accel.

RESTRAINT SYSTEM: Both dummies were unrestrained.

*As measured over final one foot of travel.

**As measured forward of the midpoint of the test vehicle's wheelbase.

POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #001	PASSENGER #002
HEAD	Left front top window sill	Left C-pillar
CHEST	Left front door	Left rear door
ABDOMEN	Left front door	Left rear door
LEFT KNEE	Left front door	Left rear door
RIGHT KNEE	Left knee	Left knee

DOOR OPENING:

	LEFT	RIGHT
FRONT	*	Easy
REAR	*	Easy

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
FRONT	NA	NA
REAR	NA	NA

GLAZING DAMAGE:

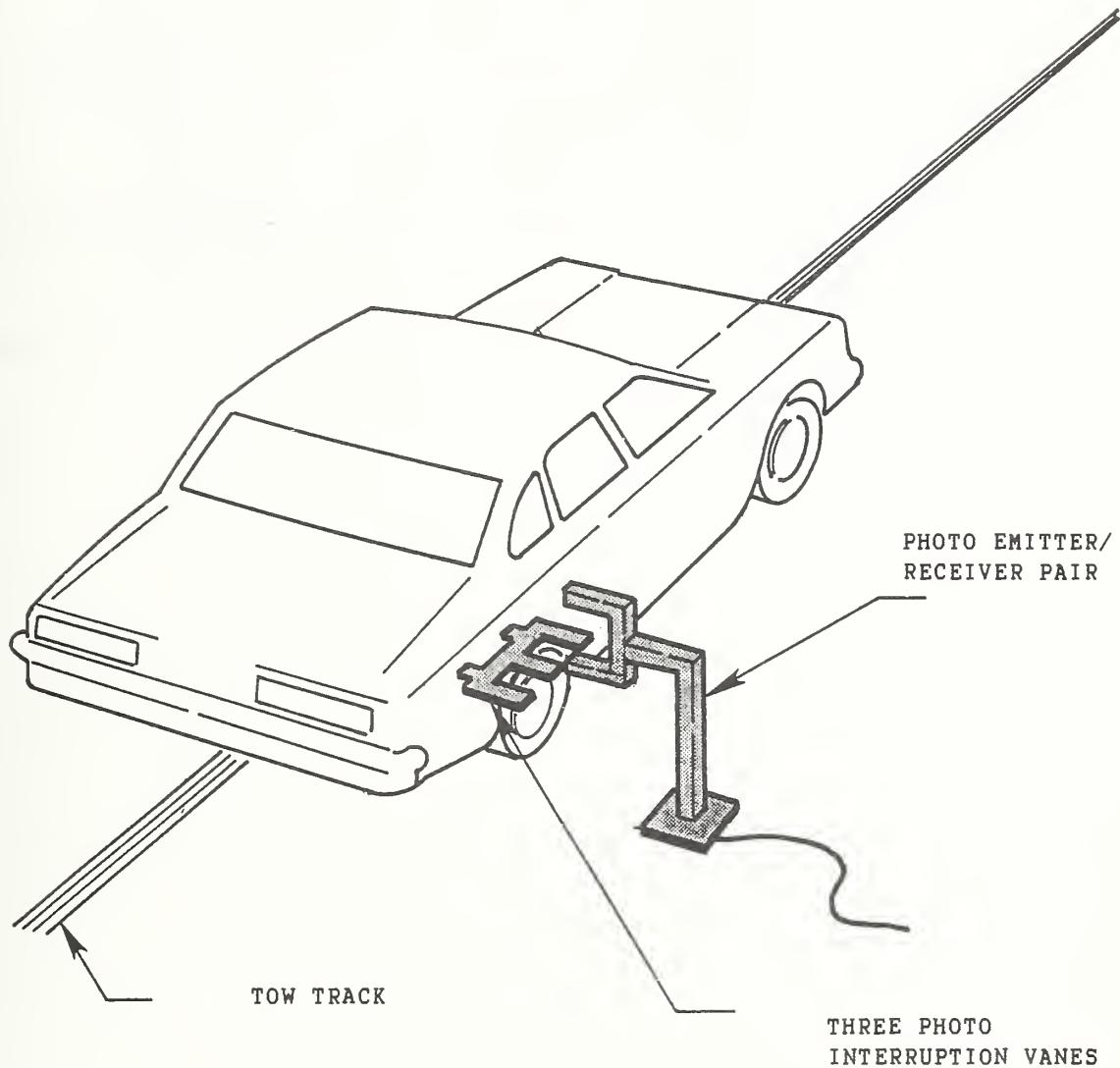
The left side windows were shattered. The windshield
was cracked.

OTHER NOTABLE IMPACT EFFECTS:

None

*The left front door to be opened later by VRTC.

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane clears emitter/receiver two inches before impact.

The vanes have one foot spacing.

TEST ANOMALIES

The driver left shoulder Y-axis accelerometer, SHLYG1, data contained one spike at 225.25 milliseconds.

The driver left shoulder Y-axis velocity, SHLYV1, data was affected by the above anomaly.

The barrier rear crossmember X-axis accelerometer, BRCXG, data failed during the event.

The barrier rear crossmember X-axis velocity, BRCXV, data was affected by the above anomaly.

SECTION 3.0

DATA REQUIRED BY R&D

The following pages are included in this section:

1. Dummy temperature control and positioning data
2. Dummy kinematic summary
3. Vehicle crush data
4. Dummy and vehicle accelerometer location and data summary
5. High speed camera information
6. Transducer information

DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle was kept inside the temperature controlled crash test building until approximately 2 hours prior to the test. Temperature inside the vehicle and ambient temperature at the crash area were recorded. Dummy temperature while outside the crash test building was maintained by portable air conditioning units until approximately 1 minute prior to the test.

The following Side Impact Dummy Seating Procedure summarizes the steps taken to position the instrumented, calibrated dummies in the test vehicle.

SIDE IMPACT DUMMY SEATING PROCEDURE

1. Seat Positioning

- A. Place seat at the longitudinal midpoint of fore to aft adjustment (forward most locking position to rear most locking position). If no locking position is available at mid-travel, use the position immediately rearward of mid-travel.
- B. If the seat back angle is adjustable, place it in the manufacturer's stated nominal design location. If not specified, set it at the first detent rearward of 25°.
- C. Adjustable head restraints are set so that the top surface of the restraint is level with the cg of the dummy's head.
- D. If the seat is equipped with adjustable side or lumbar supports, they are set in their "released" or full back positions.
- E. All other seat adjustments are positioned to their mid-travel locations. If locking positions are not available at these mid-points, use the position immediately rearward, down, left or clockwise of mid-travel. Clockwise is defined looking rear to front or left to right relative to the vehicle. This also applies to adjustable steering columns.

2. H-point Determination

- A. The SAE three-dimensional H-point machine (SAE J826 APR80 - 50th percentile male configuration) is used to locate the H-point for each surrogate.
- B. The H-point machine is positioned on the seat as follows:
 1. Bucket or Contoured Seats - The H-point machine is centered on the bucket or contour such that its midsagittal plane is vertical and longitudinal.

2. Bench Seats
 - a. driver position - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and contains the steering wheel center point.
 - b. outboard passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and the same distance from the longitudinal vehicle centerline as that for the driver position.
 - c. center passenger positions - The H-point machine is positioned such that its midsagittal place is vertical and contains the longitudinal vehicle centerline.
- C. Locate the H-point position using the steps outlined in sections 4 through 6 of SAE Standard J826 APR80, unless otherwise specified in section 1 or 2 of this document. Record the coordinates of this point, relative to the vehicle, for use in sections 4 and 5 of this document.

3. Test Dummies

- A. This side impact crash test uses the BioSid side impact dummy.
- B. The arm position is fully down and the end of the arm is 1/4" away from the left side of the dummy.
- C. All dummy joints are inspected for mobility prior to each test usage and reset to hold between 1 and 2 g's. This amount just barely restrains the weight of the individual limb when it is extended horizontally.
- D. Each test dummy is clothed in form-fitting cotton stretch underwear with short sleeves and mid-calf length pants. Each foot of the dummy is equipped with a size 11EE shoe which meets the configuration, size, sole, and heel thickness specifications of MIL-S-13192 and weighs 1.25 ± 0.2 pounds. All the above items are supplied by the contractor.

4. Initial Dummy Placement

The BioSid dummy(s) is placed in the vehicle seat with its pelvis positioned such that a lateral line passing through the dummy H-point is perpendicular to the longitudinal centerplane of the vehicle.

A. Bucket or Contoured Seats. The dummy is centered on the bucket or contoured seat such that its midsagittal place is vertical and longitudinal. The legs are positioned as follows, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible.

1. driver position placement - The right foot of the dummy is initially placed on the undepressed accelerator pedal, with the heel resting on the floorpan as far forward as possible. The knees of the dummy are initially set 8 1/2 inches apart, measured between the center surfaces of the knee.
2. passenger position placement - The knees of the dummy are initially set 8 1/2 inches apart, measured between the center surfaces of the knee. If a center tunnel prevents this, place the feet on either side of the tunnel.
3. center passenger position - The dummy is positioned in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical and contains the vehicle centerline.

5. Initial Dummy Positioning

A. H-Point Positioning

1. Determine the dummy's H-point target location which is the point .25-inch below the H-point position determined by using the SAE J826 APR80 manikin in section 2.0.
2. With the dummy laterally positioned as in section 4, insert the pelvis angle indicator bar in the hole provided above, and to the

rear of the dummy H-point. Position the longitudinal pelvis angle between 23° and 25° to the horizontal. This may be accomplished by raising the legs or flexing the upper torso forward and allowing the pelvis to rotate. The lateral pelvis angle is to be horizontal.

3. Apply sufficient force on the lower torso in a horizontal and vertical direction to place the dummy H-point at the coordinates obtained in section 5.A.1.
4. If the H-point cannot be placed at the desired coordinates, adjust the pelvis angle within the 2° band and reposition to the coordinates. After repositioning the H-point, any deviation from the desired coordinates is recorded and used to indicate actual H-point locations. This deviation is not to exceed 1/2".

6. Final Dummy Positioning

- A. Driver Position. Without inducing pelvis or torso movement, the dummy's right foot is maintained on the undepressed accelerator pedal with the heel resting as far forward as possible on the floorpan. The left foot is set perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel. If possible within these constraints, the dummy's thighs should be in contact with the seatpan.
- B. Front Passenger Positions. Without inducing pelvis or torso movement, place the dummy's feet on the vehicle's toeboard with the heels resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed on the toeboard, they are set perpendicular to the lower legs and placed as far forward as possible such that the heels rest on the floorpan.
- C. Rear Passenger Positions. Without inducing pelvis or torso movement, the feet are placed flat on the floorpan and beneath the front seat as far forward as possible without front seat interference. If necessary, change the distance between the knees as required to place the feet beneath the seat. Record the new distance.

D. Vehicles with wheelhouse projections in the passenger compartment. The foot (feet) in question is placed in the wheel of the floorpan/toeboard and not on the wheelhouse projection. This is done by twisting the foot at the ankle, maintaining the upper and lower leg positions outlined in section 4. If this does not resolve the situation, move the leg of the foot in question just enough to achieve the correct position, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible. Record the new distance between the knees.

E. The knee positions are to be as outlined in section 4, unless modified as in section 6. The plane containing the femur and tibia centerlines for each leg is to be as near to vertical as possible without inducing pelvis or torso movement. Record the distance between the knees for each dummy.

F. Prior to conducting the test, the dummy position is visually checked. The dummy is to be properly positioned laterally with its midsagittal plane vertical and longitudinal, and the upper torso resting against the seat back. The H-point and pelvis angle are to be within the specified ranges and the foot, knee, and leg placements are to be as outlined. The COTR is to be satisfied with the final dummy position and any deviations from this procedure are to be approved by the COTR.

G. The final dummy position is recorded. These measurements are to include, but not be limited to, pelvis and head angles as well as actual H-point and head cg locations relative to the vehicle. The straight-line distance from the H-point to the center of the outer ankle bolt is also recorded for one of the legs (eg. left H-point to left ankle bolt).

DUMMY IN-VEHICLE POSITION RECORDING SHEET

MFR./MAKE/MODEL: General Motors, LTD./Chevrolet/Cavalier

SEAT TYPE: X Bench - Rear

ADJUSTER TYPE: X Manual

 Bucket - Front

 Power

 Split bench

 Non-adjustable

TECHNICIANS:

BUCKET SEAT BACK TYPE: Non-adjustable

1. D. Carpenter

 Adjustable reclining

2. B. Crabtree

POSITIONING DATE: 6/4/90

3. R. Cribley

AMBIENT TEMP.: 49° F TIME: 1000

4.

DRIVER DUMMY* # 001 TYPE: BioSid

Head 21.9"

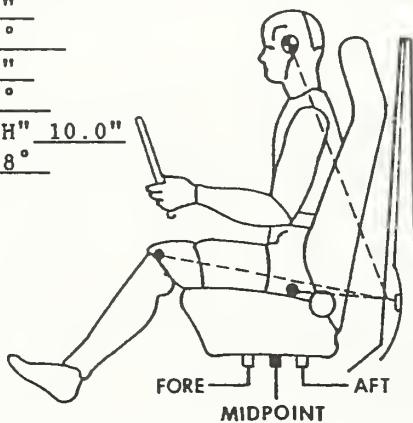
Target 5°

Knee 24.1"

Joint 88°

Approx. "H" 10.0"

Point 118°



PASSENGER DUMMY # 002 TYPE: BioSid**

Head 16.2"

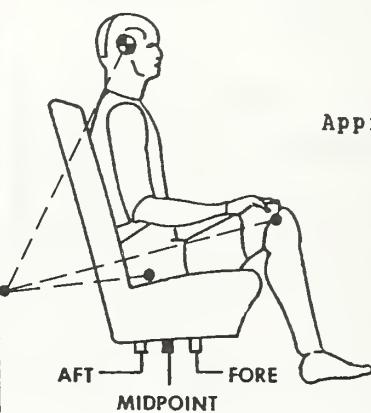
Target 8°

Knee 26.2"

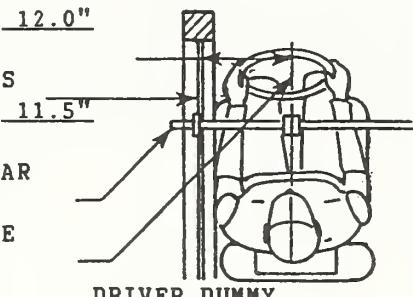
Joint 102°

Approx. "H" 15.4"

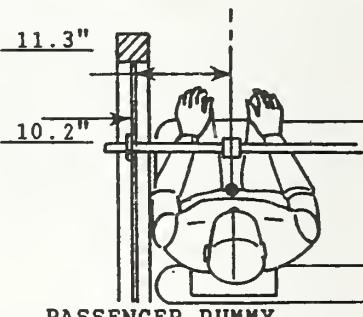
Point 137°



DOOR GLASS HEIGHT = 11.5"



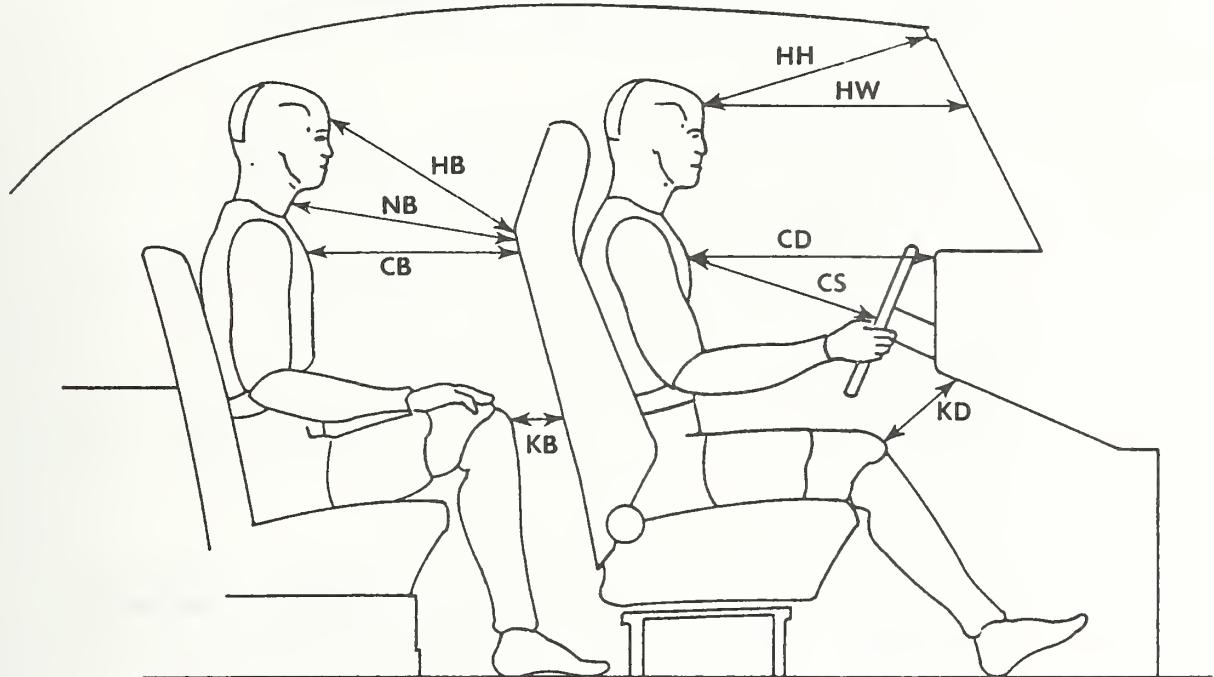
DOOR GLASS HEIGHT = 10.2"



*Driver dummy measurements are referenced to top of left front door striker bolt and all angles referenced to vertical.

**Passenger dummy measurements are referenced to top of left rear door striker bolt and all angles are referenced to vertical.

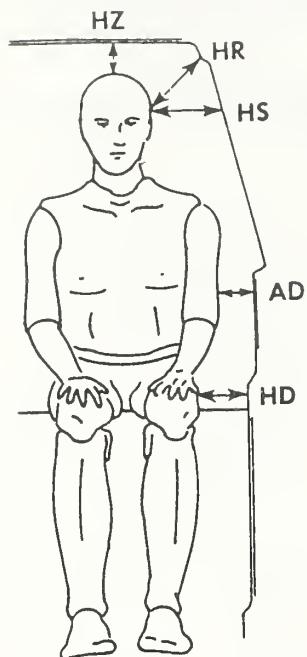
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS



	DRIVER	REAR PASSENGER
HH	13.8	NA
HW	18.5	NA
CD	18.0	NA
CS	13.9	NA
KDL	2.9	NA
KDR	2.8	NA
HB	NA	25.9
NB	NA	23.3
CB	NA	18.2
KBL	NA	4.4
KBR	NA	4.4

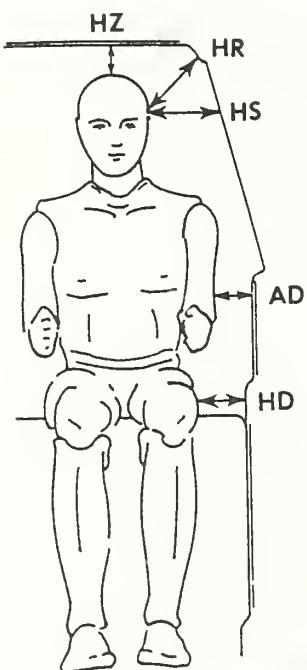
ALL MEASUREMENTS ARE IN INCHES.

DUMMY LATERAL CLEARANCE DIMENSIONS



	DRIVER	PASSENGER
HR	6 . 2	6 . 0
HS	8 . 8	8 . 4
AD	3 . 7	3 . 2
HD	6 . 2	6 . 0
HZ	3 . 4	1 . 6

ALL DISTANCE MEASUREMENTS ARE
IN INCHES.



SAE 3D H-POINT MACHINE LOCATION AND DUMMY LOCATION DATA

	DRIVER #001	PASSENGER #002
SAE 3D H-POINT MACHINE LOCATION:	X = 7.20 Z = -3.75	X = 9.90 Z = -9.60
DUMMY H-POINT LOCATION:	X = 7.40 Z = -4.00	X = 9.90 Z = -9.80
DUMMY PELVIC ANGLE:	24°	25°

*The driver location measurements referenced to the left front door striker bolt and the passenger location measurements referenced to the left rear door striker bolt in two dimensional rectangular coordinates: +X = forward, +Z = upward

All dimensions in inches except as noted.

All angles referenced to horizontal, positive is upward.

DUMMY KINEMATIC SUMMARY

DRIVER

During impact, the dummy's torso contacted the driver's door and the head contacted the left front door top window sill. The dummy rebounded laterally across the front occupant compartment. The upper torso rotated and contacted the windshield. The left knee contacted the left front door and the right knee contacted the left knee. The dummy's pelvis came to rest against the right front door and the upper torso was leaning to the center of the vehicle.

PASSENGER

During impact, the dummy's torso contacted the left rear door and the head contacted the left C-pillar. The dummy rebounded laterally across the rear occupant compartment. The left knee contacted the left rear door and the right knee contacted the left knee. The dummy's pelvis came to rest against the right rear door and the upper torso was leaning to the center of the vehicle.

VEHICLE EXTERIOR PROFILES AND STATIC CRUSH
ZERO DISTANCE AT PROJECTED IMPACT POINT*

LOCATION	HEIGHT (IN)	-6	0	6	12	18	24	30	36	42	48	54	60	66	72	78
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**))																
Axle Height	11.5	X	X	18.6	18.6	18.6	18.6	18.7	18.7	18.7	18.7	18.8	18.8	X	X	X
H-Point	17.9	X	16.5	16.3	16.2	16.2	16.1	16.2	16.2	16.1	16.1	16.1	16.1	16.1	16.2	X
Mid Door	22.1	X	15.8	15.5	15.4	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	X
Window Sill	33.5	18.7	18.4	18.2	18.2	18.1	18.0	18.0	17.9	17.9	17.9	17.8	17.7	17.7	17.8	17.8
Window Top	51.5	X	X	X	X	X	X	26.1	26.4	26.4	26.4	26.5	26.5	26.4	26.5	26.6

POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**))

LOCATION	HEIGHT (IN)	-6	0	6	12	18	24	30	36	42	48	54	60	66	72	78
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**))																
Axle Height	11.5	X	X	21.8	25.2	26.1	26.8	27.2	27.8	28.4	28.5	28.5	28.5	28.5	28.5	28.5
H-Point	17.9	X	18.5	29.4	30.2	30.9	31.1	31.2	31.4	30.7	30.7	30.7	30.5	30.5	30.5	30.5
Mid Door	22.1	X	18.0	29.5	30.5	30.5	30.6	30.7	30.8	30.8	30.8	30.6	30.5	30.5	30.5	30.5
Window Sill	33.5	19.2	18.9	19.2	26.4	27.6	27.6	27.7	27.9	28.5	33.8	32.6	30.2	28.4	23.4	19.2
Window Top	51.5	X	X	X	X	X	X	28.0	28.6	29.4	29.4	28.5	28.5	27.9	27.6	27.5

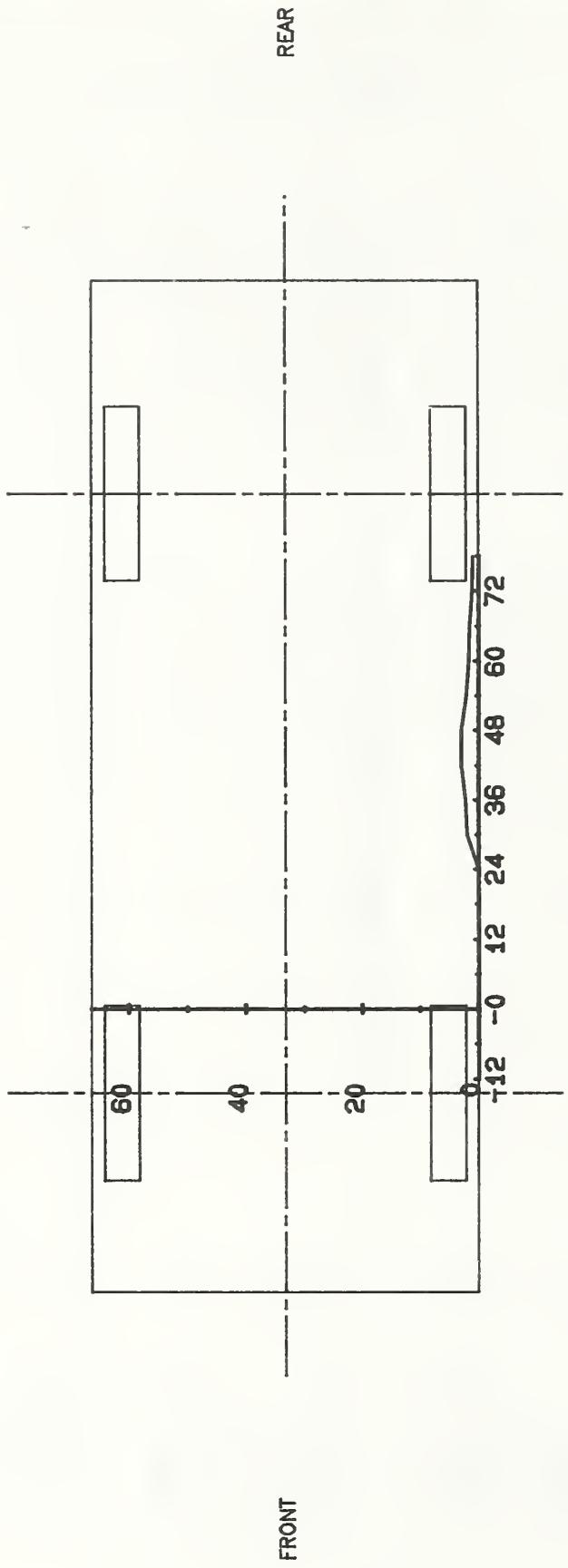
STATIC CRUSH (IN)

LOCATION	HEIGHT (IN)	-6	0	6	12	18	24	30	36	42	48	54	60	66	72	78
STATIC CRUSH (IN)																
Axle Height	11.5	X	X	3.2	6.6	7.5	8.2	8.5	9.7	9.7	9.8	7.1	4.4	2.4	X	X
H-Point	17.9	X	2.0	13.1	14.0	14.7	15.0	15.0	15.2	14.6	14.1	14.4	14.1	12.8	1.9	X
Mid Door	22.1	X	2.2	14.0	15.1	15.2	15.3	15.4	15.5	15.5	15.3	15.2	14.8	13.8	8.8	X
Window Sill	33.5	0.5	0.5	1.0	8.2	9.5	9.6	9.7	10.0	10.6	15.9	14.8	12.5	10.7	5.6	1.4
Window Top	51.5	X	X	X	X	X	X	1.9	2.2	2.9	3.0	2.1	1.7	1.5	1.1	0.9

* Projected impact point is 37 inches forward of driver's side wheelbase midpoint. Column readings are front to rear from left to right.

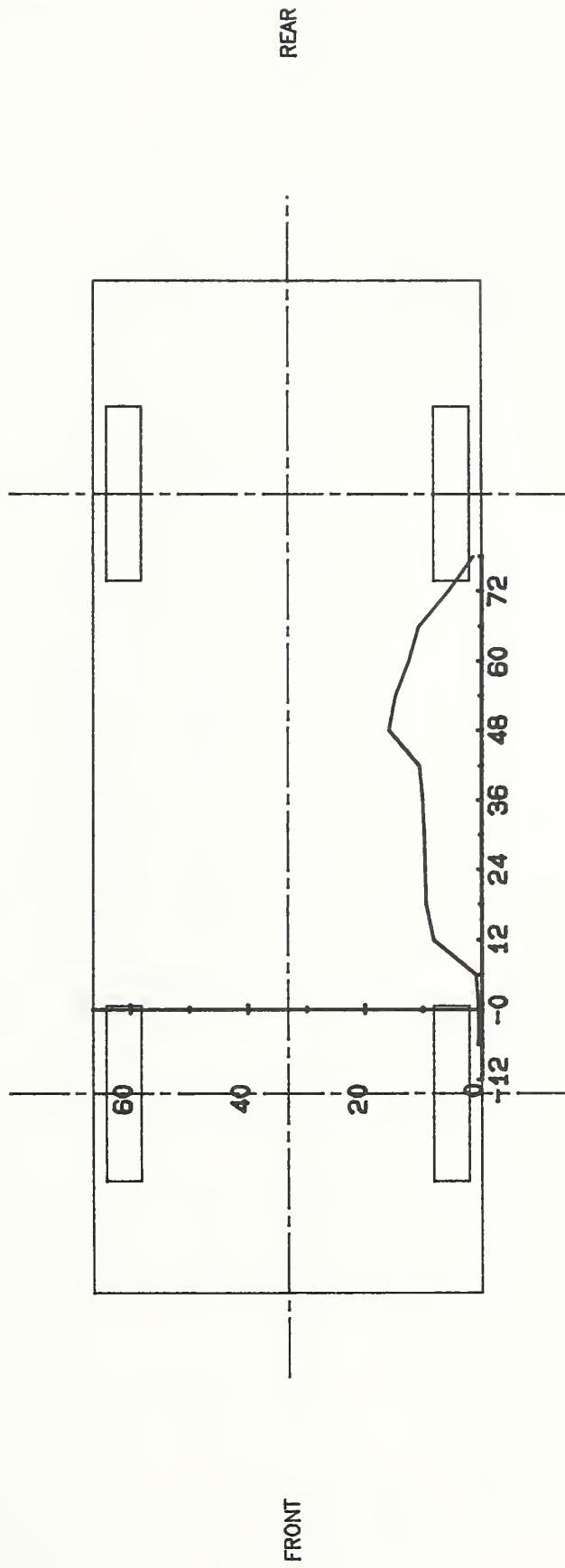
** Reference plane is parallel to and 48 inches from the vehicle longitudinal centerline.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



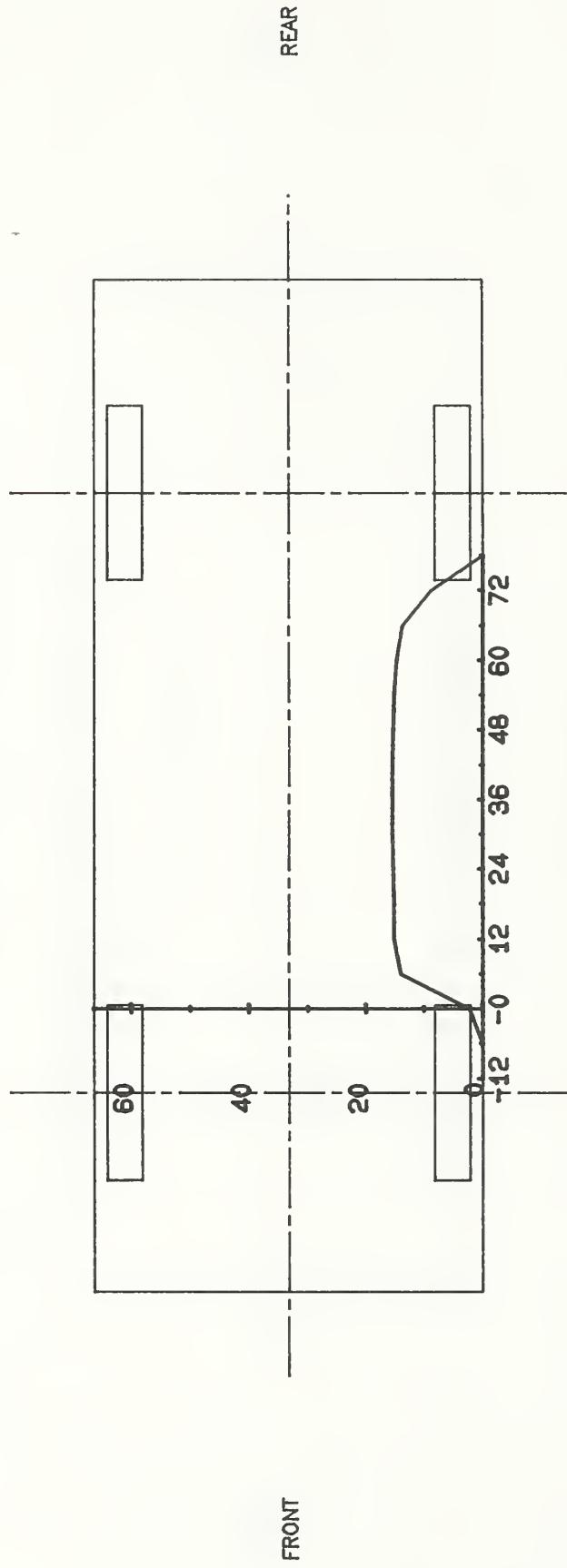
PROFILE LEVEL EQUALS WINDOW TOP HEIGHT WHICH IS 51.5" ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



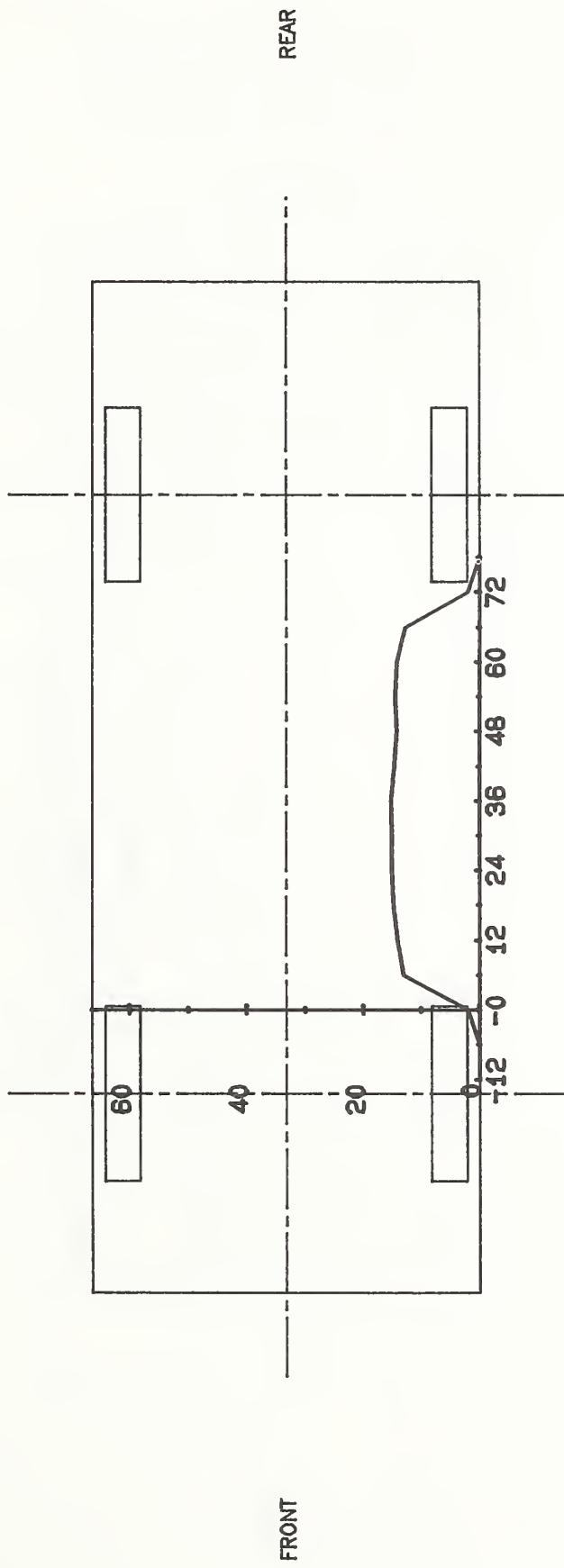
PROFILE LEVEL EQUALS WINDOW SILL HEIGHT WHICH IS 33.5" ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



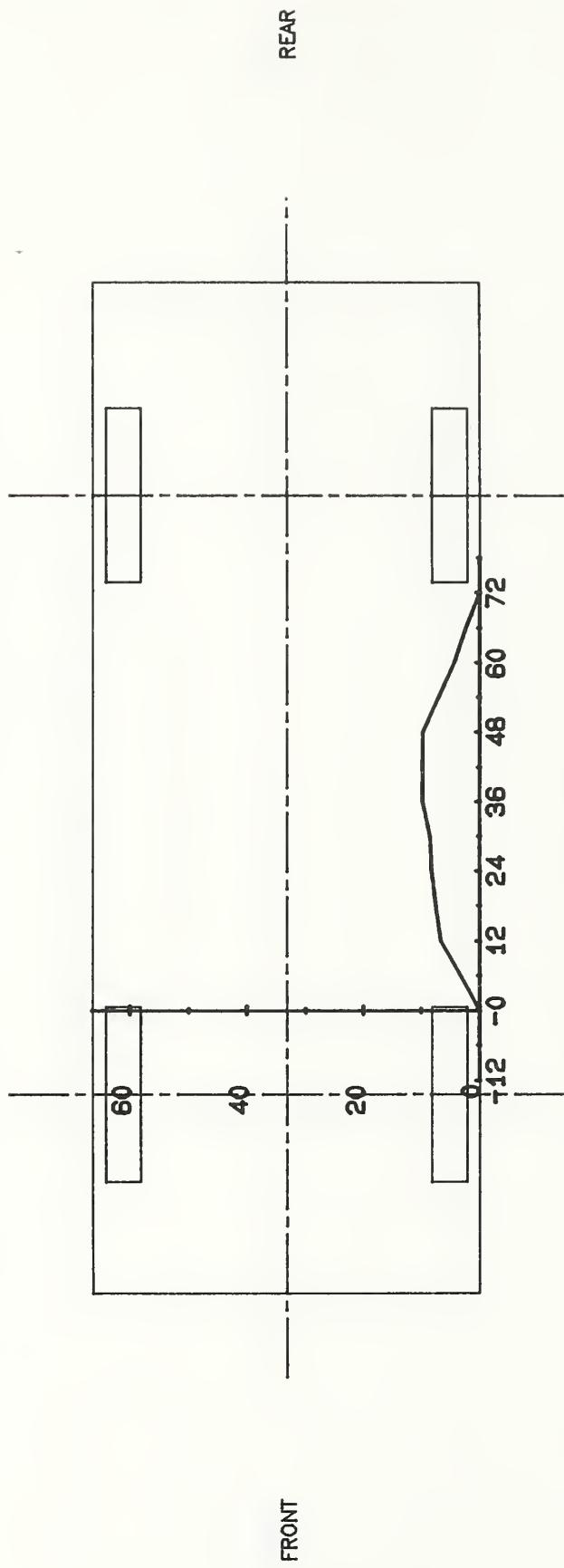
PROFILE LEVEL EQUALS MID DOOR HEIGHT WHICH IS 22.1" ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS H-POINT HEIGHT WHICH IS 17.9" ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS AXLE HEIGHT WHICH IS 11.5" ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

DUMMY DATA SUMMARY

TEST NUMBER 900604

DRIVER DUMMY

SN: 001

POSITIVE DIRECTION		NEGATIVE DIRECTION	
MAX	MSEC	MAX	MSEC

HEAD

LONGITUDINAL ACCEL. (g)	25.4	243.9	13.3	214.8
LATERAL ACCEL. (g)	36.1	50.1	21.3	182.1
DELTA V (MPH)	19.1	122.4		
VERTICAL ACCEL. (g)	18.7	243.9	49.4	46.6
RESULTANT ACCEL. (g)	58.0	47.9		
HIC	181.9 FROM 40.6 TO 58.9 MSEC			

LEFT SHOULDER

LATERAL ACCEL. (g)	100.8	35.6 Y	29.9	41.2 Y
DELTA V (MPH)	19.6	39.2 Y		
LONGITUDINAL FORCE (N)	941.4	237.8	193.4	55.5
LATERAL FORCE (N)	3034.0	42.8	716.4	226.3
VERTICAL FORCE (N)	549.6	255.8	678.0	37.6
LATERAL DISPL. (mm)	29.5	43.1	1.2	243.3

UPPER SPINE

LONGITUDINAL ACCEL. (g)	15.6	52.5	5.5	74.4
LATERAL (P) ACCEL. (g)	63.5	38.8	14.9	62.5
DELTA V (MPH)	24.9	52.5		
LATERAL (R) ACCEL. (g)	64.1	38.8	14.4	62.5
DELTA V (MPH)	25.1	52.5		
VERTICAL ACCEL. (g)	11.7	36.9	6.9	70.6
RESULTANT (P) ACCEL. (g)	64.3	38.8		
RESULTANT (R) ACCEL. (g)	64.9	38.8		

LEFT UPPER THORAX RIB

LATERAL (P) ACCEL. (g)	98.5	36.9	28.2	309.4
DELTA V (MPH)	20.7	40.6		
LATERAL (R) ACCEL. (g)	97.4	36.3	37.6	56.3
DELTA V (MPH)	21.5	40.6		
LATERAL DISPL. (mm)	32.5	43.6	1.2	65.1

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 900604

DRIVER DUMMY

SN: 001

	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC

LEFT CENTER THORAX RIB

LATERAL (P) ACCEL. (g)	97.9	36.3	39.5	42.5
DELTA V (MPH)	21.7	40.6		
LATERAL (R) ACCEL. (g)	97.0	36.3	38.5	309.4
DELTA V (MPH)	22.4	40.6		
LATERAL DISPL. (mm)	40.3	43.8	0.8	65.8

LEFT LOWER THORAX RIB

LATERAL (P) ACCEL. (g)	93.6	23.8	50.9	42.5
DELTA V (MPH)	20.5	40.0		
LATERAL (R) ACCEL. (g)	100.0	23.8	45.6	310.0
DELTA V (MPH)	23.4	40.6		
LATERAL DISPL. (mm)	45.0	43.5	0.0	16.5

THORACIC TRAUMA INDEX

TTI (P)	79.7			
TTI (R)	80.5			

LOWER SPINE

LONGITUDINAL ACCEL. (g)	26.7	30.6	19.0	51.3
LATERAL (P) ACCEL. (g)	60.9	33.7	6.7	96.3
DELTA V (MPH)	24.0	51.8		
LATERAL (R) ACCEL. (g)	61.1	33.7	6.9	93.8
DELTA V (MPH)	23.8	51.8		
VERTICAL ACCEL. (g)	21.4	34.4	5.0	48.8
RESULTANT (P) ACCEL. (g)	67.0	33.1		
RESULTANT (R) ACCEL. (g)	67.1	33.1		

LEFT UPPER ABDOMEN

LATERAL ACCEL. (g)	94.5	55.0	31.3	60.6
DELTA V (MPH)	9.2	23.8		
LATERAL DISPL. (mm)	44.5	38.1	0.7	57.4

LEFT LOWER ABDOMEN

LATERAL ACCEL. (g)	151.3	16.9	59.0	25.6
DELTA V (MPH)	13.9	23.1		
LATERAL DISPL. (mm)	67.6	45.5	0.3	16.5

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 900604

DRIVER DUMMY

SN: 001

POSITIVE DIRECTION	NEGATIVE DIRECTION
MAX	MSEC

<hr/> PELVIS <hr/>					
LONGITUDINAL ACCEL. (g)	6.3	191.9	20.5	37.5	
LATERAL ACCEL. (g)	108.7	27.5	5.8	268.7	
DELTA V (MPH)	27.4	46.2			
VERTICAL ACCEL. (g)	18.3	31.3	7.3	25.6	
RESULTANT ACCEL. (g)	109.3	27.5			

<hr/> PELVIS PUBIC SYMPHYSIS <hr/>					
LATERAL FORCE (N)	2924.0	37.3	140.1	294.1	

<hr/> PELVIS SACRUM <hr/>					
LATERAL FORCE (N)	761.9	99.6	2317.4	33.5	

<hr/> PELVIS ILIAC <hr/>					
LATERAL FORCE (N)	5509.8	28.1	141.1	60.8	

POSITIVE DIRECTION

LONGITUDINAL: FORWARD
 LATERAL: RIGHTWARD
 VERTICAL: UPWARD
 FORCE: COMPRESSION

NEGATIVE DIRECTION

LONGITUDINAL: REARWARD
 LATERAL: LEFTWARD
 VERTICAL: DOWNWARD
 FORCE: EXTENSION

NOTES:

For dummy channels Delta V is the velocity change at the approximate time of separation from the contact area.

(P) Primary Sensor
 (R) Redundant Sensor

γ See TEST ANOMALIES

DUMMY DATA SUMMARY

TEST NUMBER 900604

PASSENGER DUMMY			
SN: 002			
POSITIVE DIRECTION MAX	MSEC	NEGATIVE DIRECTION	
		MAX	MSEC

HEAD

LONGITUDINAL ACCEL. (g)	8.1	189.1	26.6	53.8
LATERAL ACCEL. (g)	84.2	58.8	14.8	73.6
DELTA V (MPH)	19.3	68.5		
VERTICAL ACCEL. (g)	10.2	34.5	34.4	51.8
RESULTANT ACCEL. (g)	87.6	58.8		
HIC	478.3 FROM 51.6 TO 61.5 MSEC			

LEFT SHOULDER

LATERAL ACCEL. (g)	44.5	37.5	5.4	94.4
DELTA V (MPH)	22.4	57.1		
LATERAL DISPL. (mm)	9.8	44.8	0.9	28.6

UPPER SPINE

LONGITUDINAL ACCEL. (g)	1.8	237.5	14.2	46.3
LATERAL (P) ACCEL. (g)	45.3	42.5	2.9	196.2
DELTA V (MPH)	20.6	60.0		
VERTICAL ACCEL. (g)	9.8	40.0	6.5	77.5
RESULTANT (P) ACCEL. (g)	47.3	43.1		

LEFT UPPER THORAX RIB

LATERAL (P) ACCEL. (g)	58.9	35.6	4.8	85.6
DELTA V (MPH)	21.2	54.4		
LATERAL (R) ACCEL. (g)	59.1	35.6	6.5	55.6
DELTA V (MPH)	22.0	53.8		
LATERAL DISPL. (mm)	18.6	45.9	0.3	177.5

LEFT CENTER THORAX RIB

LATERAL (P) ACCEL. (g)	86.4	35.0	4.0	96.9
DELTA V (MPH)	21.6	53.1		
LATERAL (R) ACCEL. (g)	83.1	35.6	3.8	106.9
DELTA V (MPH)	21.8	53.1		
LATERAL DISPL. (mm)	28.6	44.4	0.1	25.0

LEFT LOWER THORAX RIB

LATERAL (P) ACCEL. (g)	97.1	35.0	8.0	53.7
DELTA V (MPH)	18.4	40.0		
LATERAL (R) ACCEL. (g)	97.2	35.0	8.4	53.7
DELTA V (MPH)	18.4	40.0		
LATERAL DISPL. (mm)	32.8	44.0	0.8	143.6

THORACIC TRAUMA INDEX

TTI (P)	83.1
TTI (R)	82.8

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 900604

PASSENGER DUMMY

SN: 002

POSITIVE DIRECTION	NEGATIVE DIRECTION		
MAX	MSEC	MAX	MSEC

LOWER SPINE

LONGITUDINAL ACCEL. (g)	13.5	33.1	16.4	41.9
LATERAL (P) ACCEL. (g)	69.1	39.4	6.0	96.9
DELTA V (MPH)	24.5	58.8		
LATERAL (R) ACCEL. (g)	68.5	40.0	5.7	102.5
DELTA V (MPH)	23.8	58.8		
VERTICAL ACCEL. (g)	32.7	39.4	9.5	73.1
RESULTANT (P) ACCEL. (g)	77.7	40.0		
RESULTANT (R) ACCEL. (g)	77.2	40.0		

LEFT UPPER ABDOMEN

LATERAL ACCEL. (g)	143.3	31.9	41.1	36.9
DELTA V (MPH)	19.2	35.6		
LATERAL DISPL. (mm)	49.4	45.3	3.7	154.9

LEFT LOWER ABDOMEN

LATERAL ACCEL. (g)	160.6	20.0	91.1	25.0
DELTA V (MPH)	13.6	23.1		
LATERAL DISPL. (mm)	65.8	49.4	0.1	4.3

PELVIS

LONGITUDINAL ACCEL. (g)	10.9	61.2	38.0	32.5
LATERAL ACCEL. (g)	96.9	31.9	6.6	69.4
DELTA V (MPH)	27.8	58.8		
VERTICAL ACCEL. (g)	25.8	32.5	5.6	73.8
RESULTANT ACCEL. (g)	106.5	32.5		

POSITIVE DIRECTION

LONGITUDINAL:	FORWARD
LATERAL:	RIGHTWARD
VERTICAL:	UPWARD
FORCE:	COMPRESSION

NEGATIVE DIRECTION

LONGITUDINAL:	REARWARD
LATERAL:	LEFTWARD
VERTICAL:	DOWNWARD
FORCE:	EXTENSION

NOTES:

For dummy channels Delta V is the velocity change at the approximate time of separation from the contact area.

(P) Primary Sensor

(R) Redundant Sensor

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 900604

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
					MAX G	MSEC	MAX G	MSEC
1	RIGHT SILL AT FRONT SEAT	108.8	24.9	10.5	2.2	60.0	7.3	24.9
					19.3	12.4	3.6	78.9
					4.4	33.8	5.3	27.0
					19.3	12.4		
					Delta VY is 13.5 MPH @ 72.6 MSEC			
2	RIGHT SILL AT REAR SEAT	75.2	25.0	10.6	2.0	41.8	7.3	24.6
					16.8	33.0	5.1	78.6
					3.5	256.4	4.7	71.8
					18.0	33.1		
					Delta VY is 15.4 MPH @ 74.6 MSEC			
3	REAR DECK OVER AXLE	35.5	-3.0	12.9	4.2	13.4	12.2	25.3
					20.8	32.1	4.4	193.9
					14.3	19.4	17.2	32.1
					27.1	32.0		
					Delta VY is 20.6 MPH @ 96.1 MSEC			
4	LEFT SILL AT REAR SEAT	75.8	-24.9	11.0	98.0	9.1	144.1	14.8
					Delta VY is 10.9 MPH @ 8.2 MSEC			
5	LEFT SILL AT FRONT SEAT	109.2	-24.9	11.0	104.7	9.6	114.8	16.1
					Delta VY is 12.9 MPH @ 9.6 MSEC			
6	LEFT FRONT DOOR CENTERLINE	97.9	-27.1	26.0	165.7	13.1	144.3	22.0
					Delta VY is 27.0 MPH @ 17.2 MSEC			
7	RIGHT TRUNK FLOOR	43.0	12.4	17.6	4.1	15.0	9.3	26.1
8	LEFT REAR DOOR MID REAR	59.2	-27.6	25.4	190.6	16.5	95.4	24.5
					Delta VY is 30.5 MPH @ 16.0 MSEC			

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY CONTINUED

TEST NUMBER 900604

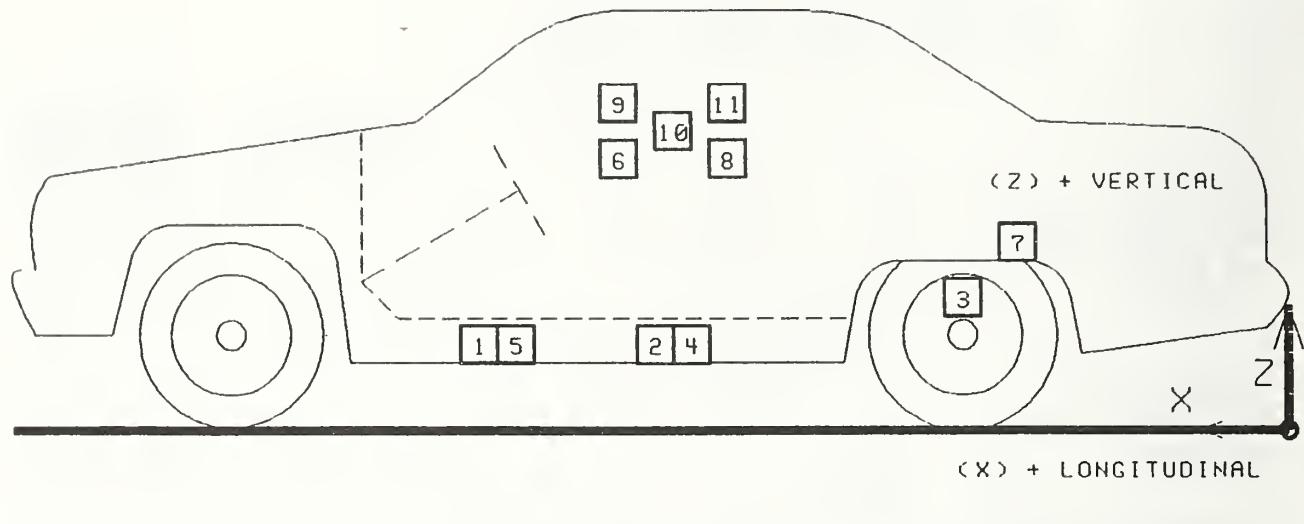
No.	LOCATION	X*	Y*	Z*	POSITIVE	NEGATIVE
					DIRECTION	DIRECTION
9	UPPER LEFT FRONT DOOR CENTERLINE LATERAL	93.8	-26.6	30.8		
					118.8	14.0
					133.3	32.0
					Delta VY is 22.6 MPH @ 18.4 MSEC	
10	MIDFRONT OF LEFT FRONT DOOR LATERAL	89.8	-26.8	26.1		
					199.1	13.3
					74.7	23.8
					Delta VY is 28.2 MPH @ 17.6 MSEC	
11	LEFT REAR DOOR UPPER CENTERLINE LATERAL	64.5	-27.4	30.4		
					159.8	13.6
					116.6	30.0
					Delta VY is 28.6 MPH @ 17.6 MSEC	

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

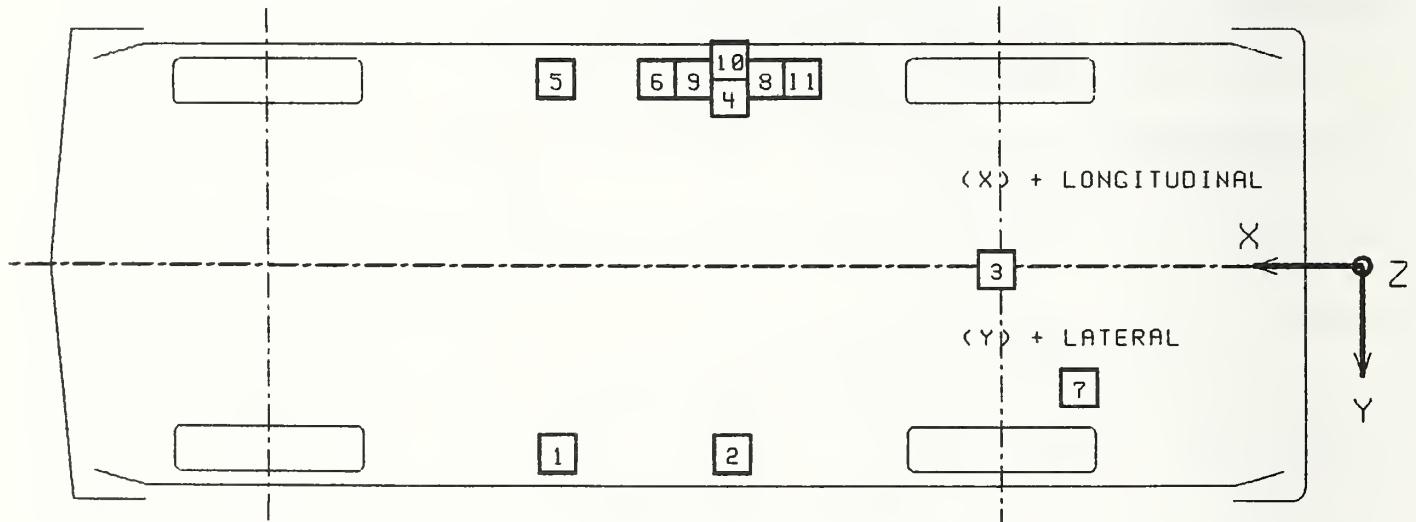
REFERENCE: X: + FORWARD FROM REAR BUMPER
 Y: + RIGHTWARD FROM VEHICLE CENTERLINE
 Z: + UPWARD FROM GROUND LEVEL

All measurements of accelerometer locations in inches.

VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 900604

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
					MAX G	MSEC	MAX G	MSEC
1	CENTER OF GRAVITY	74.2	0.0	12.2				
	LONGITUDINAL				1.5	137.0	16.8	36.6
	LATERAL				2.4	58.8	6.7	41.5
	VERTICAL				3.9	32.5	4.7	37.8
	RESULTANT				18.3	37.1		
		Delta VX is 17.4 MPH @ 106.0 MSEC						
		Delta VY is 3.7 MPH @ 106.0 MSEC						
2	REAR FRAME MEMBER	19.2	0.0	12.0				
	LONGITUDINAL				256.3	212.3	---	---
	LATERAL				5.9	34.1	2.2	102.3
		Delta VX is ---- MPH @ ---- MSEC Y						
		Delta VY is -2.2 MPH @ 51.8 MSEC						

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

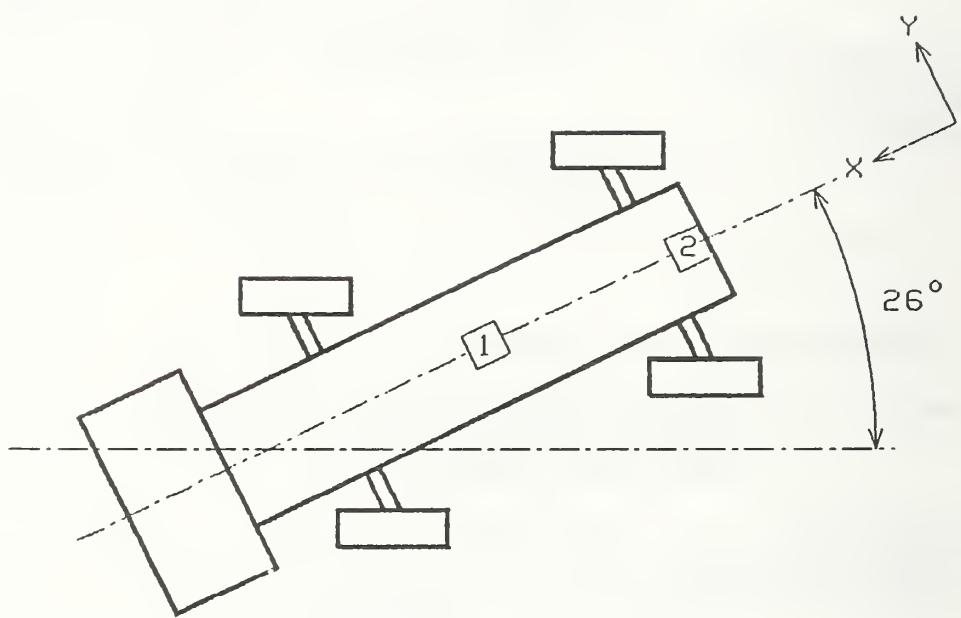
REFERENCE: X: + FORWARD FROM REAR POINT OF FRAME
 Y: + RIGHTWARD FROM BARRIER CENTERLINE
 Z: + UPWARD FROM GROUND LEVEL

All measurements of accelerometer locations in inches.

Y See TEST ANOMALIES

ε There is no negative value in the time interval of interest.

MOVING BARRIER ACCELEROMETER PLACEMENT

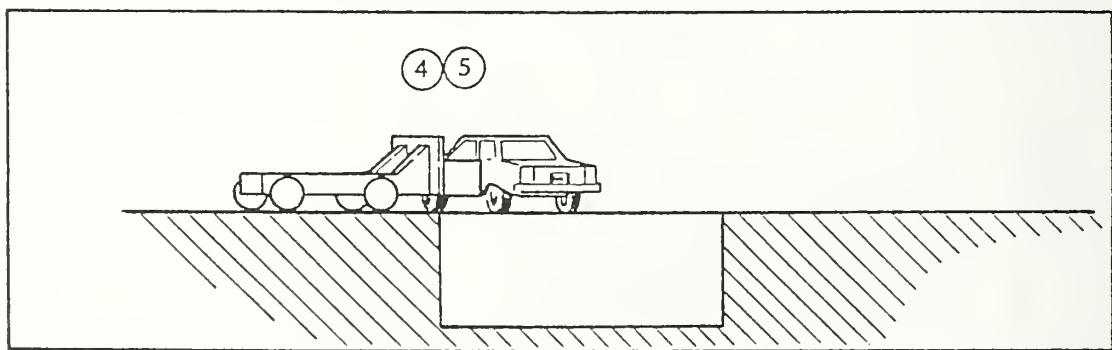
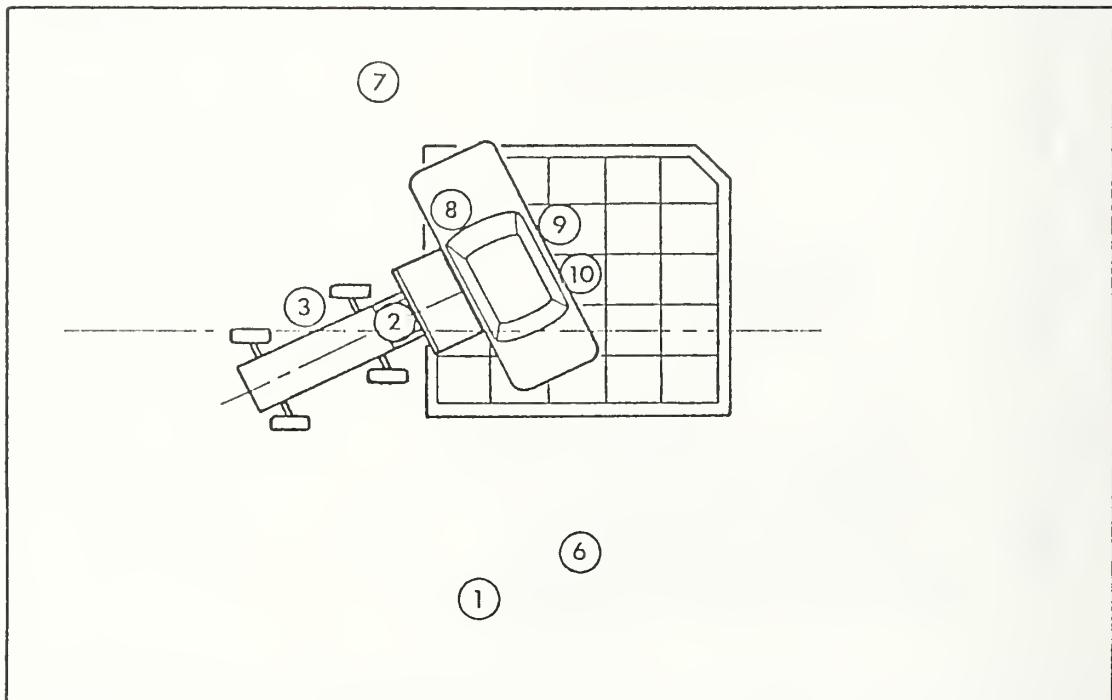


TOP VIEW

CAMERA INFORMATION

<u>CAMERA NO.</u>	<u>LOCATION</u>	<u>TYPE</u>	<u>LENS (mm)</u>	<u>SPEED (fps)</u>	<u>PURPOSE OF CAMERA DATA</u>
1	Right side panning	Kodak	25	24	Real time documentation
2	Onboard MDB - wide	Photosonic 1B	13	500	Dummy kinematics
3	Onboard MDB - tight	Photosonic 1B	25	500	Close-up of impact point
4	Overhead - wide	Photosonic 1B	8.5	502	Vehicle dynamics
5	Overhead - tight	Photosonic 1B	25	500	Close-up vehicle dynamic
6	Ground level - right	Photosonic 1B	25	502	Overall view
7	Ground level - left	Photosonic 1B	13	502	Overall view
8	Onboard windshield	Photosonic 1B	8	1000	Driver kinematics - Frt.
9	Onboard driver	Photosonic 1B	8	1000	Driver kinematics
10	Onboard passenger	Photosonic 1B	8	955	Passenger kinematics

CAMERA LOCATION



APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST VEHICLE FRONT AND BARRIER VIEW

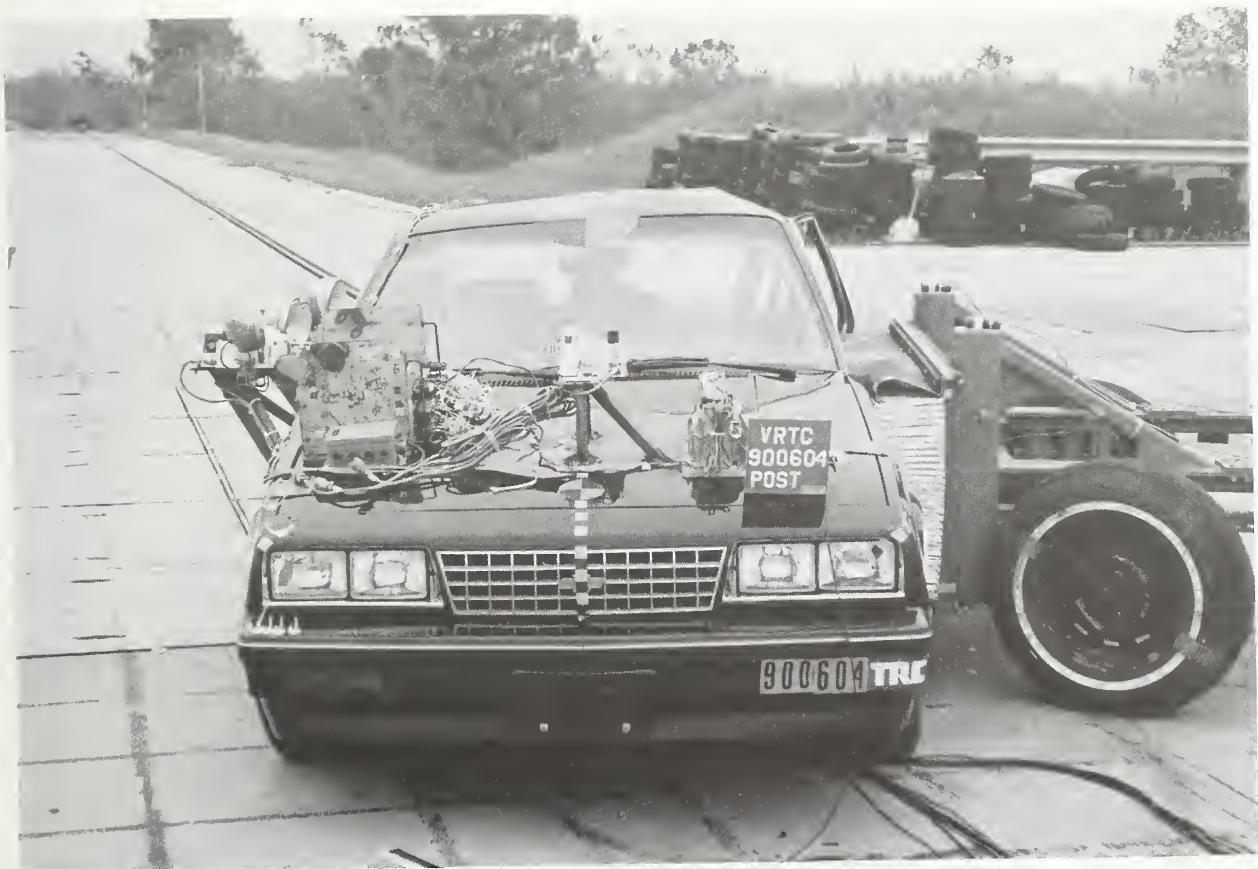


Figure A-2. POST-TEST VEHICLE FRONT AND BARRIER - VIEW 1

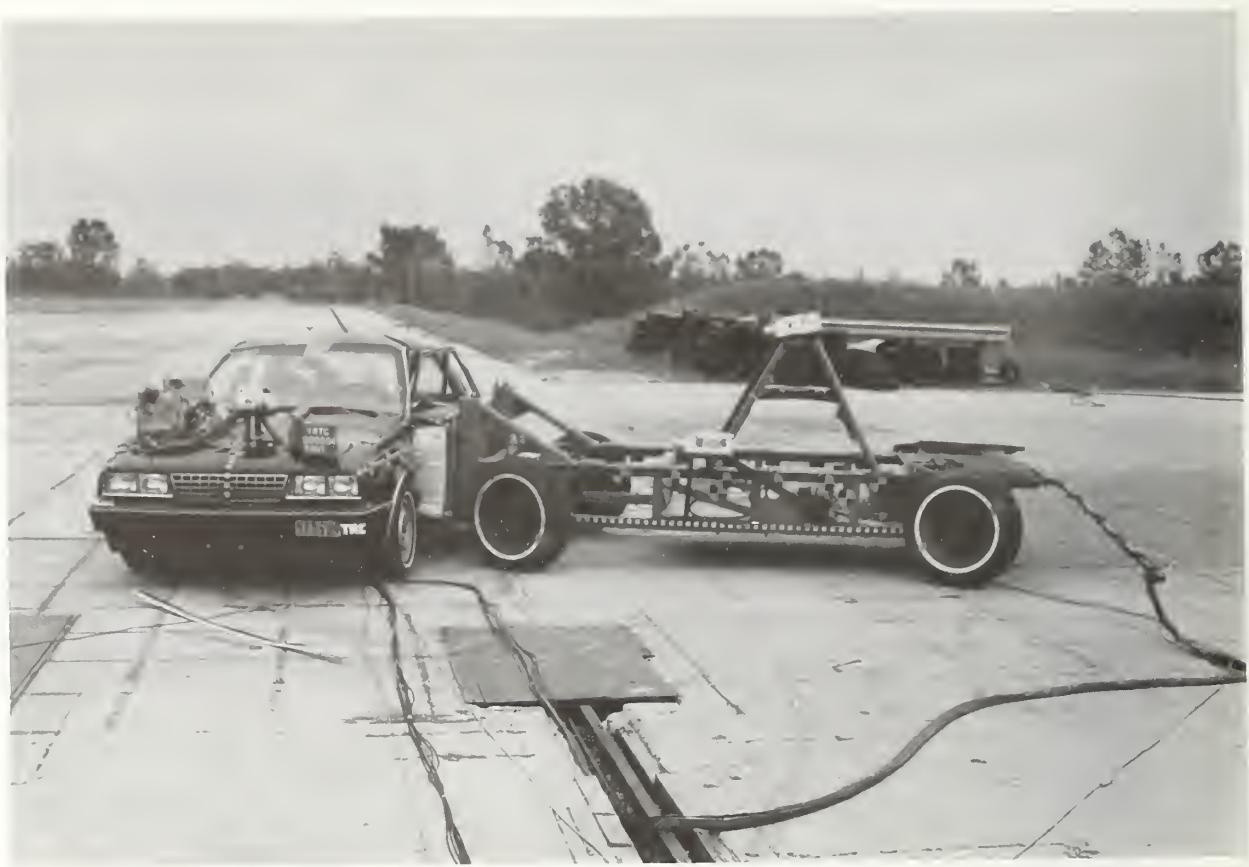


Figure A-3. POST-TEST VEHICLE FRONT AND BARRIER - VIEW 2

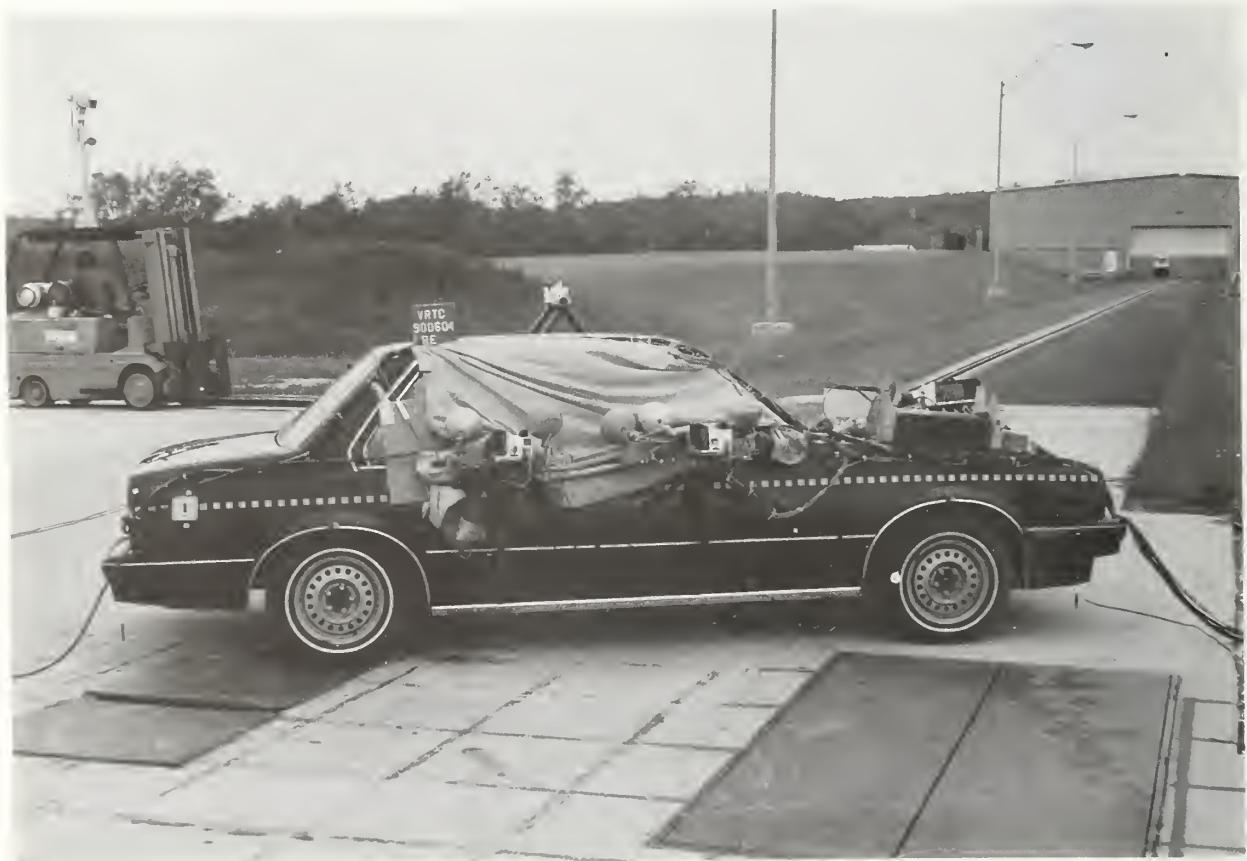


Figure A-4. PRE-TEST VEHICLE RIGHT SIDE VIEW



Figure A-5. POST-TEST VEHICLE RIGHT SIDE VIEW



Figure A-6. PRE-TEST VEHICLE REAR AND BARRIER VIEW



Figure A-7. POST-TEST VEHICLE REAR AND BARRIER VIEW



Figure A-8. PRE-TEST VEHICLE LEFT AND BARRIER VIEW



Figure A-9. POST-TEST VEHICLE LEFT AND BARRIER VIEW



Figure A-10. PRE-TEST VEHICLE LEFT SIDE VIEW



Figure A-11. POST-TEST VEHICLE LEFT SIDE - VIEW 1



Figure A-12. POST-TEST VEHICLE LEFT SIDE - VIEW 2



Figure A-13. PRE-TEST VEHICLE LEFT FRONT CLOSE-UP VIEW



Figure A-14. POST-TEST VEHICLE LEFT FRONT CLOSE-UP VIEW

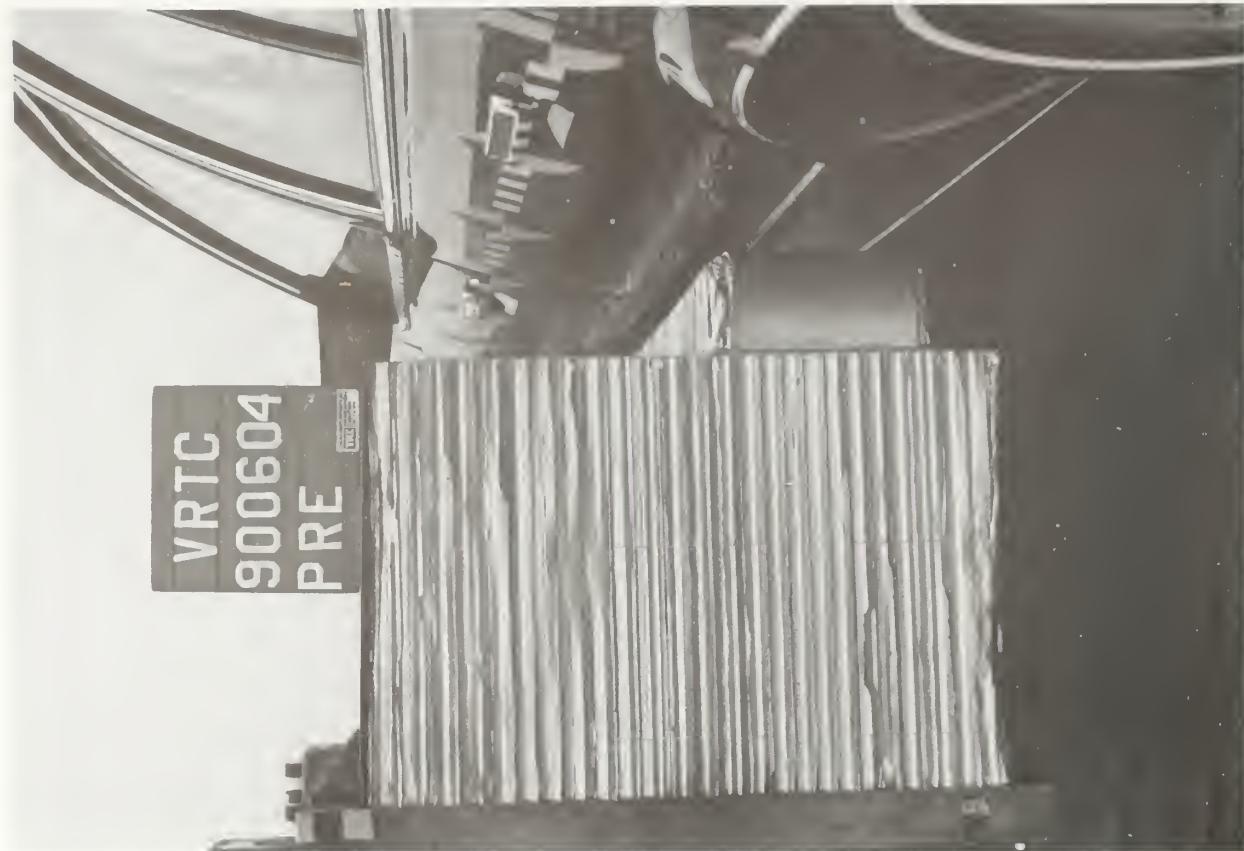


Figure A-15. PRE-TEST LEFT REAR CLOSE-UP VIEW



Figure A-16. POST-TEST VEHICLE LEFT REAR CLOSE-UP VIEW

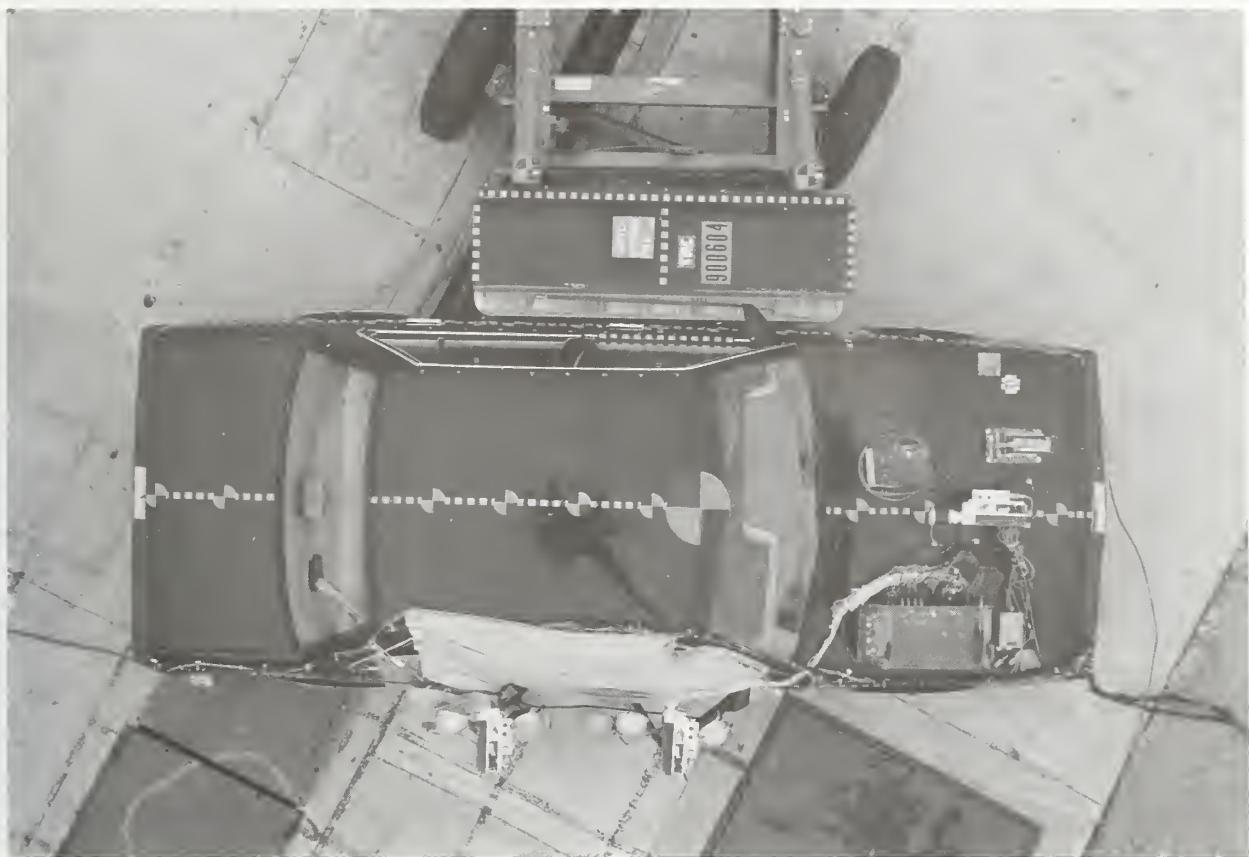


Figure A-17. PRE-TEST VEHICLE TOP - VIEW 1

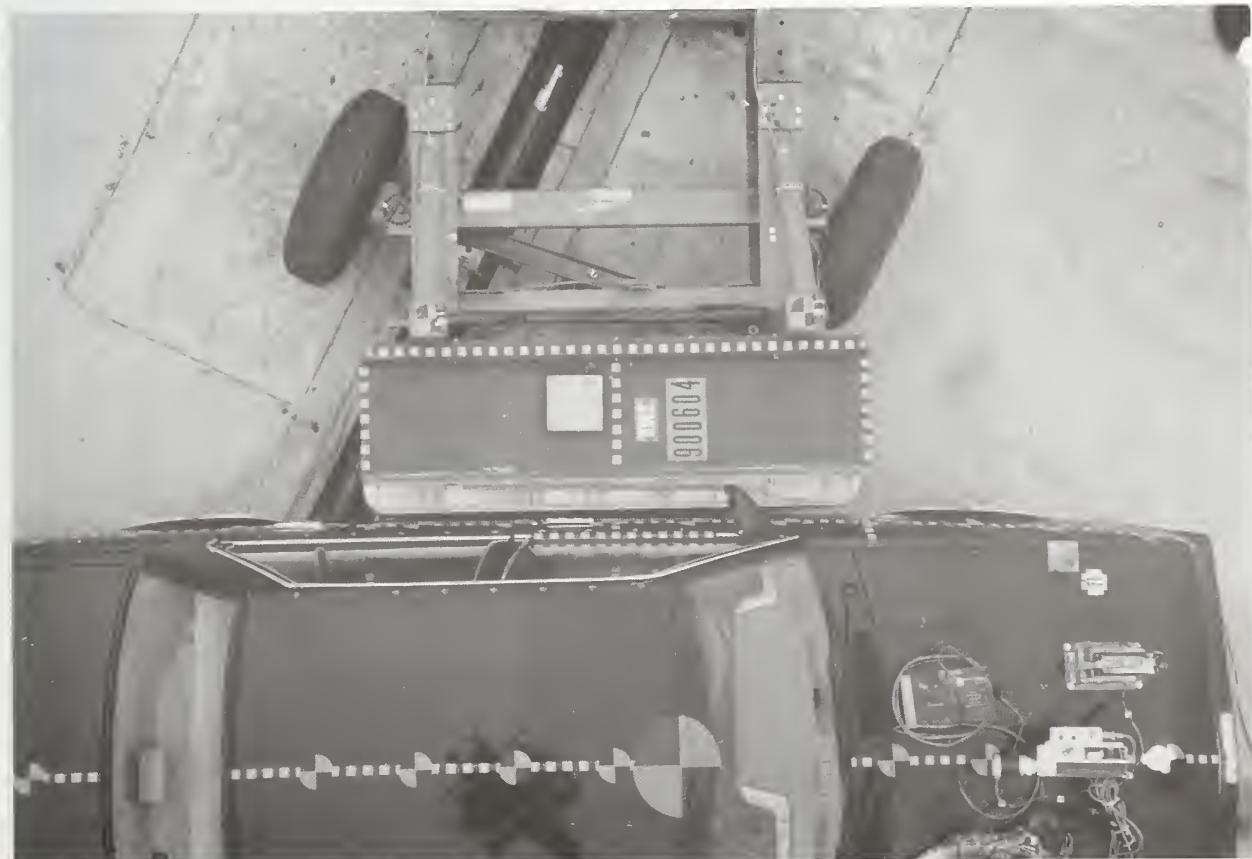


Figure A-18. PRE-TEST VEHICLE TOP - VIEW 2

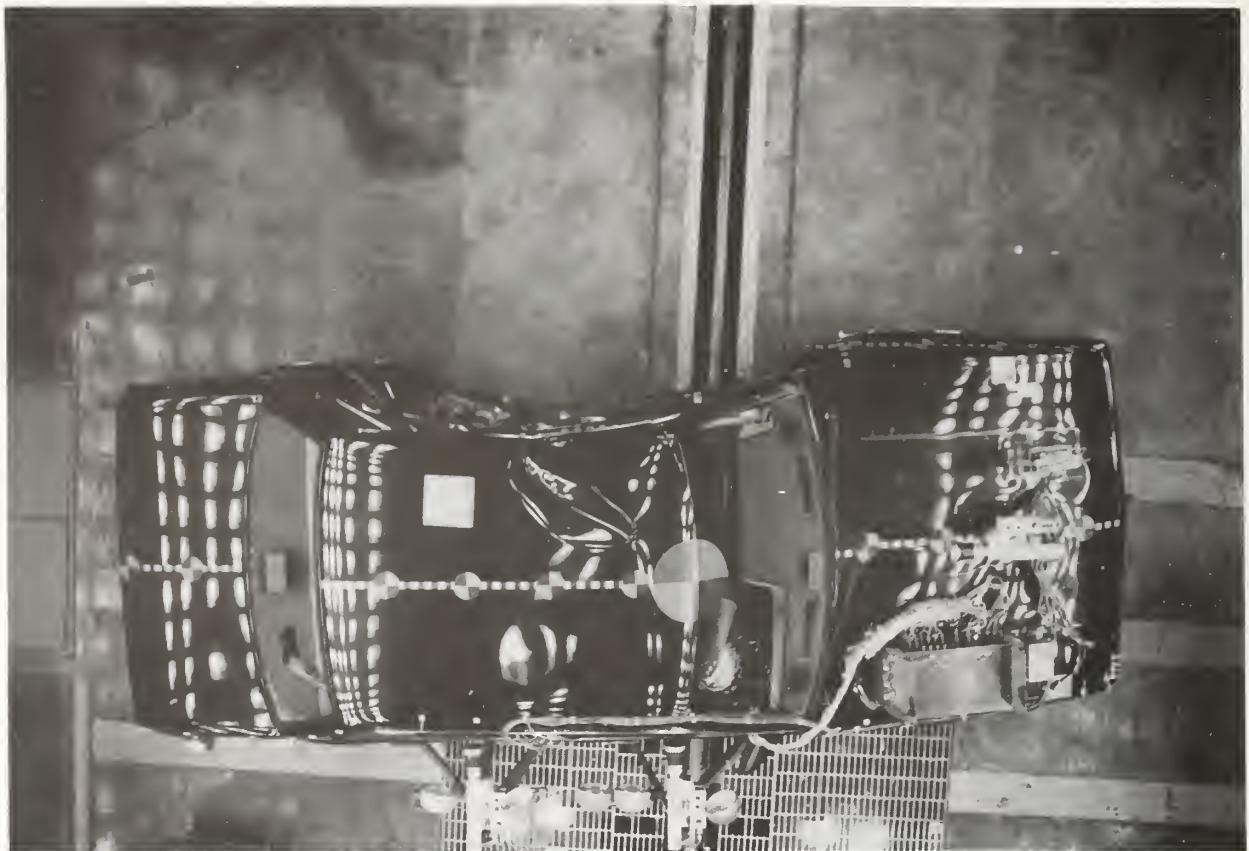


Figure A-19. POST-TEST VEHICLE TOP VIEW



Figure A-20. PRE-TEST LEFT FRONT DOOR ACCELEROMETERS VIEW



Figure A-21. PRE-TEST LEFT REAR DOOR ACCELEROMETERS VIEW



Figure A-22. PRE-TEST RIGHT FRONT SILL ACCELEROMETER VIEW



Figure A-23. PRE-TEST LEFT REAR SILL ACCELEROMETER VIEW



Figure A-24. PRE-TEST DRIVER DUMMY - VIEW 1



Figure A-25. PRE-TEST DRIVER DUMMY - VIEW 2



Figure A-26. PRE-TEST DRIVER DUMMY - VIEW 3



Figure A-27. POST-TEST DRIVER DUMMY VIEW



Figure A-28. PRE-TEST PASSENGER DUMMY - VIEW 1



Figure A-29. PRE-TEST PASSENGER DUMMY - VIEW 2



Figure A-30. POST-TEST PASSENGER DUMMY - VIEW 3



Figure A-31. POST-TEST PASSENGER DUMMY VIEW



Figure A-32. POST-TEST DRIVER DUMMY - VIEW 1



Figure A-33. POST-TEST DRIVER DUMMY - VIEW 2



Figure A-34. PRE-TEST PASSENGER DUMMY CONTACT IEW 1



Figure A-35. POST-TEST PASSENGER DUMMY CONTACT - VIEW 2

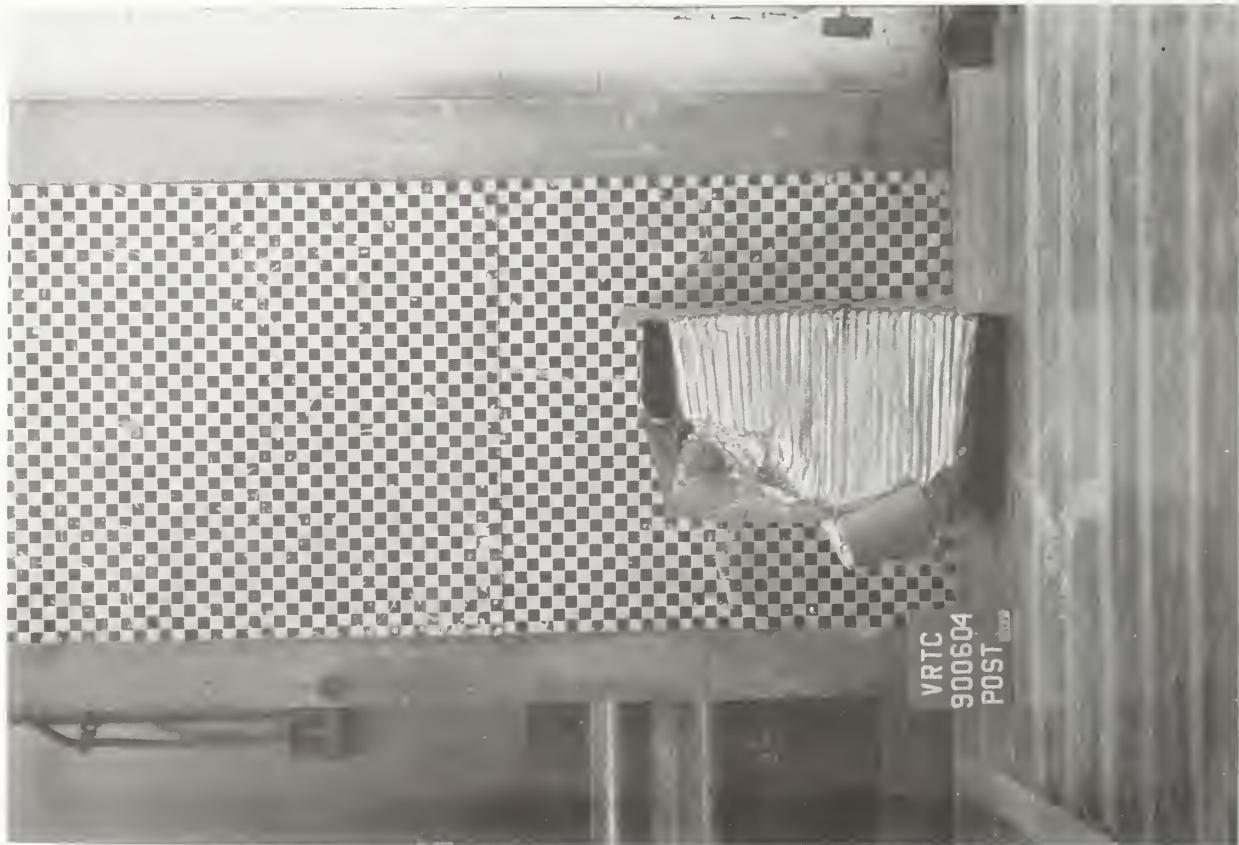


Figure A-36. POST-TEST BARRIER FACE - VIEW 1

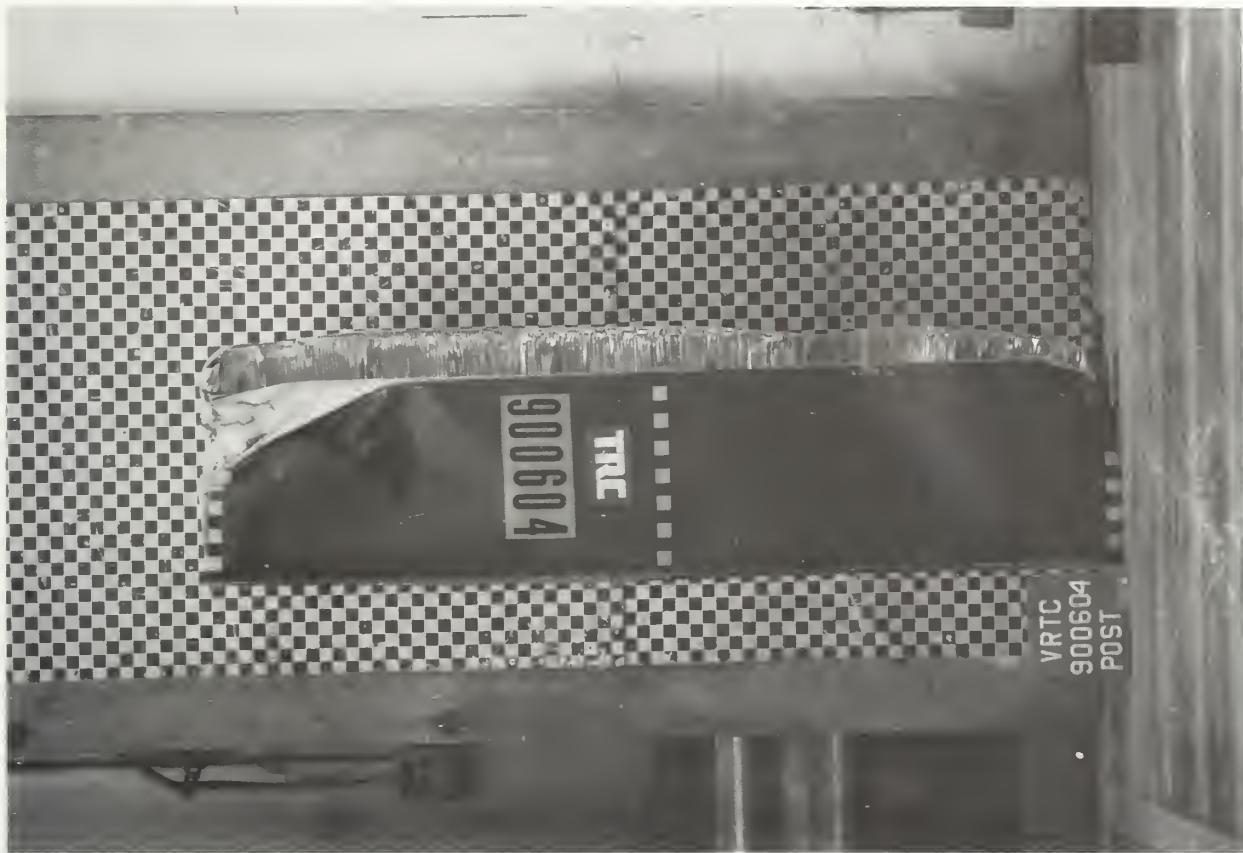


Figure A-37. POST-TEST BARRIER FACE - VIEW 2

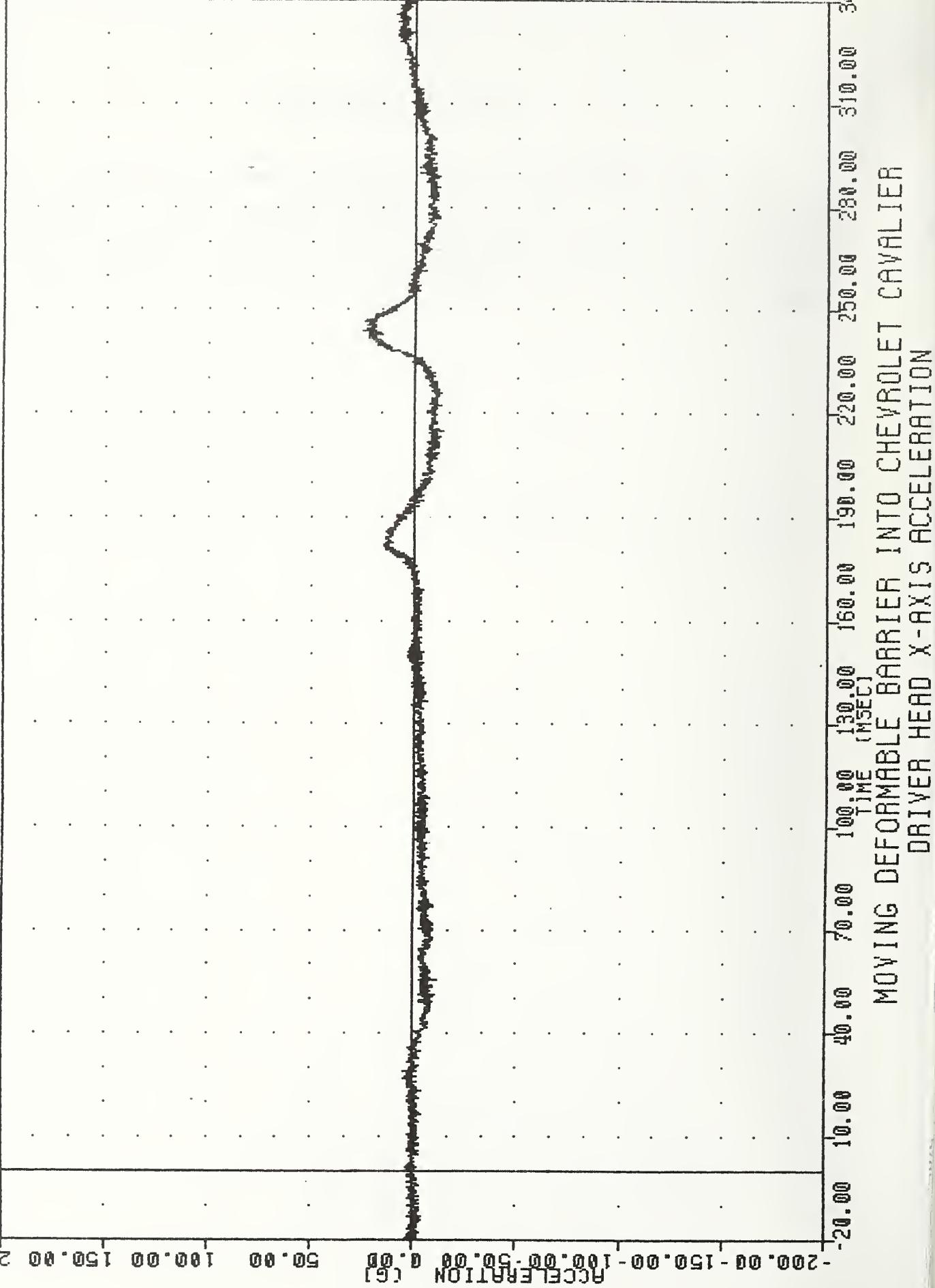
APPENDIX B

DATA PLOT PRESENTATION

Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211b, except that dummy thorax and pelvis data were filtered using the HSRI filter.

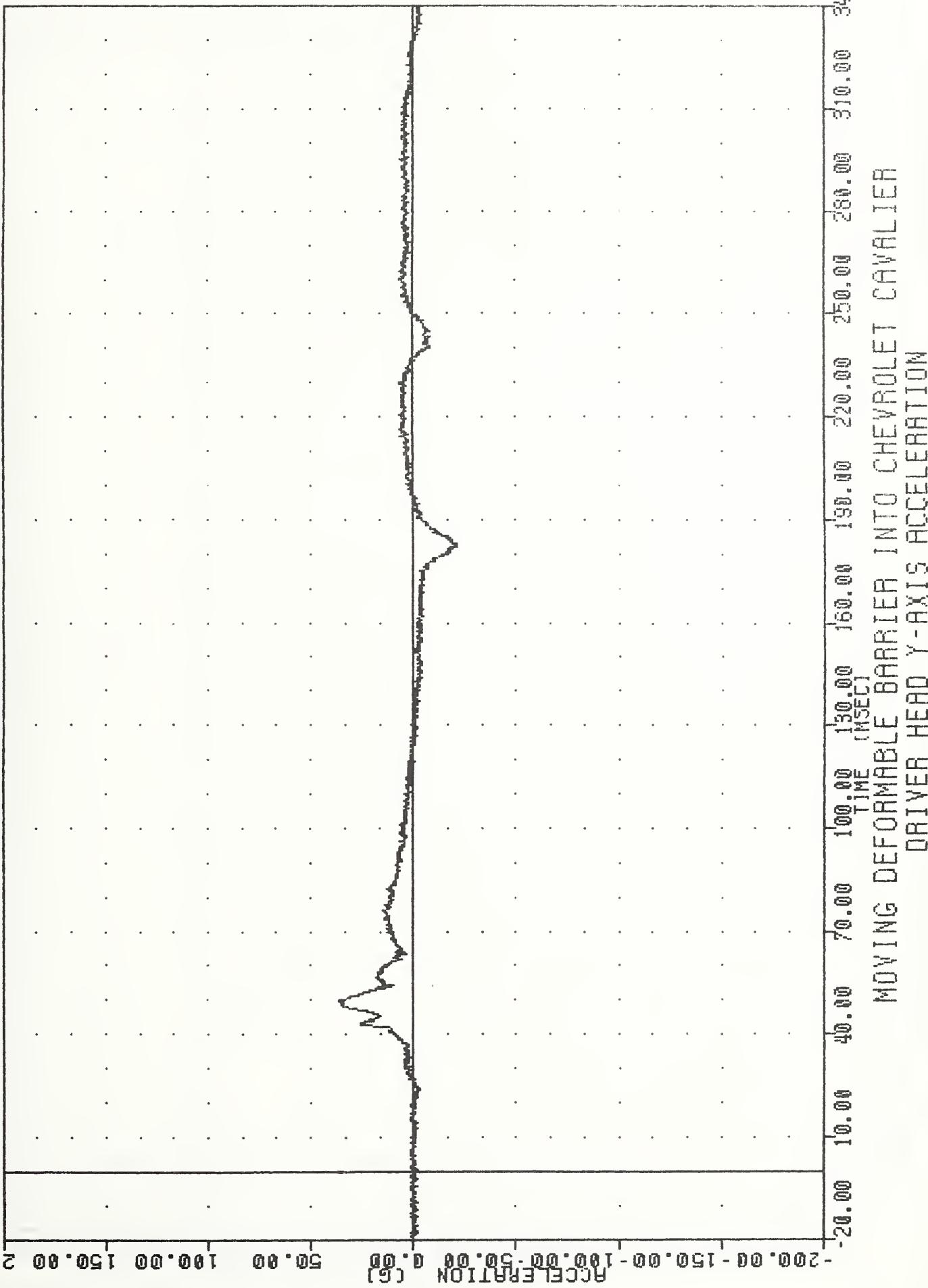
YRTC , 90@6@4
SI PROTECTION PROD VEHICLE
9@154
HEDX61

FILTER = ALPF 1650/ 5214/ -4@
MIN, MAX VALUES = -13.34@ 214.75 , 25.42 @ 243.88



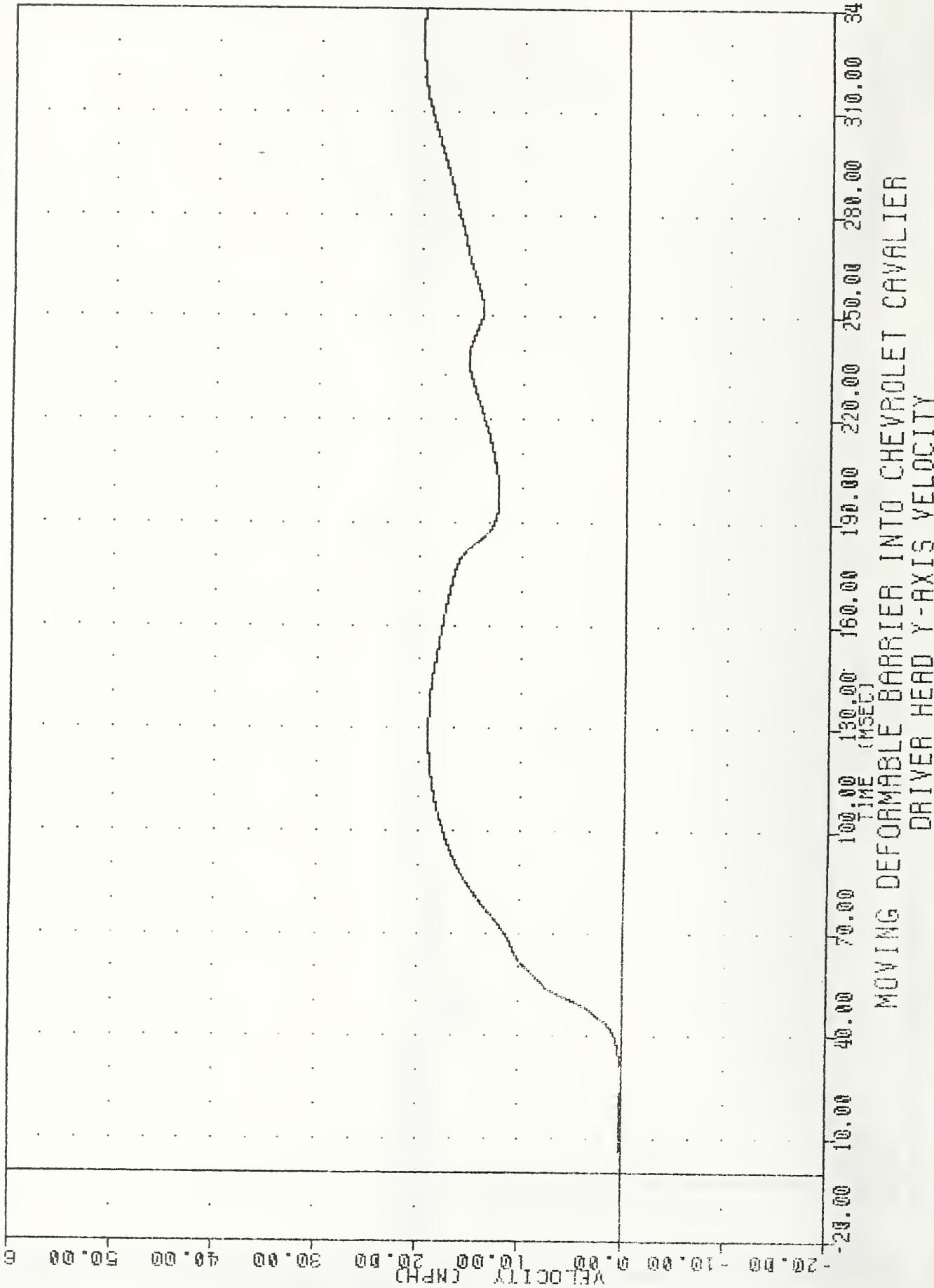
VRTC
SI PROTECTION PROD VEHICLE
90154
HEDY61

9000604
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -21.278 182.13 , 36.03 e 50.13



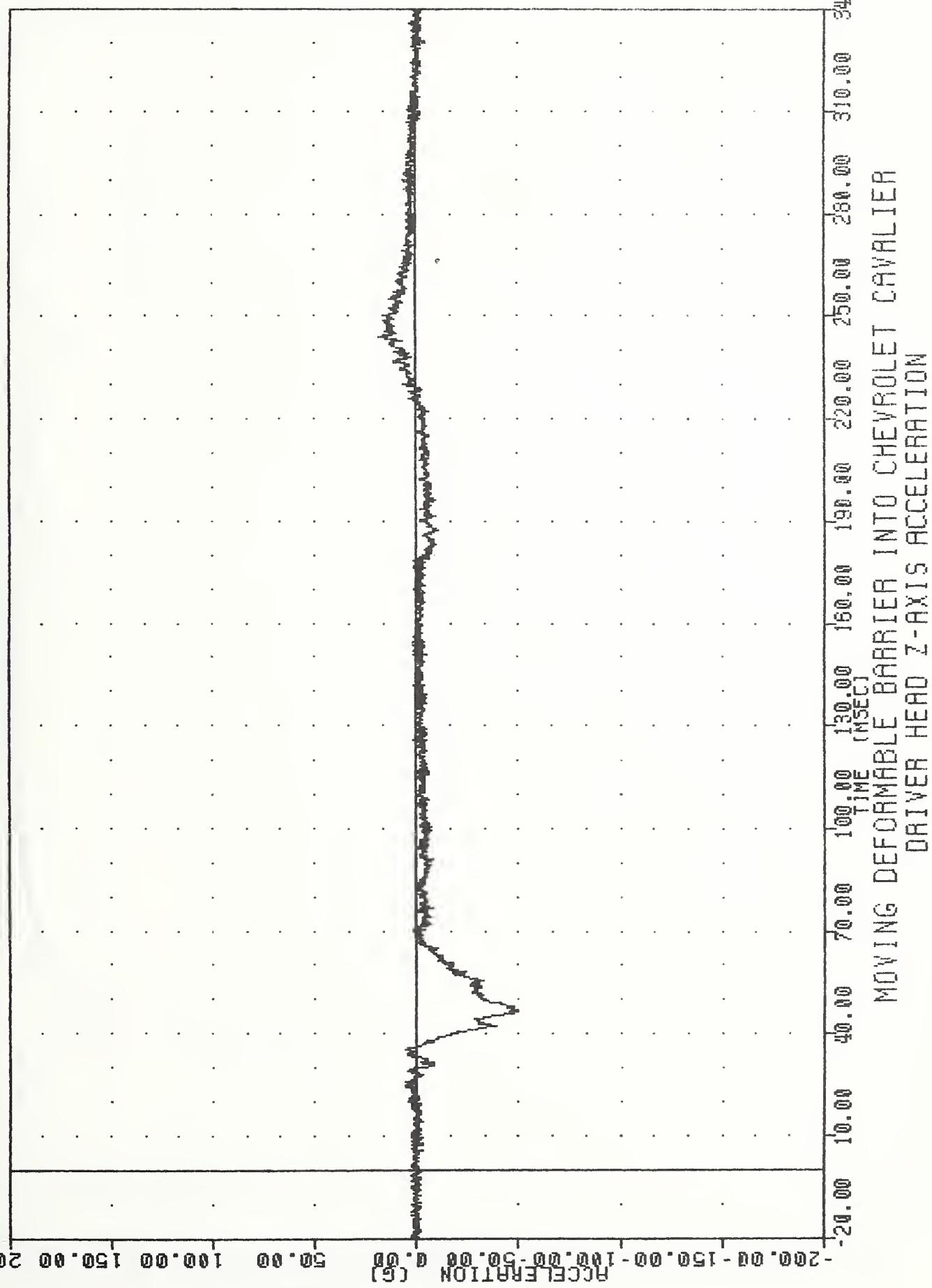
VRTC
SI PROTECTION PROD VEHICLE
90154
HEADW1
00

FILTER = BLPF 3000/ 949/ -40
MIN, MAX VALUES = -0.10 e 27.50 .
20.13 e 331.63



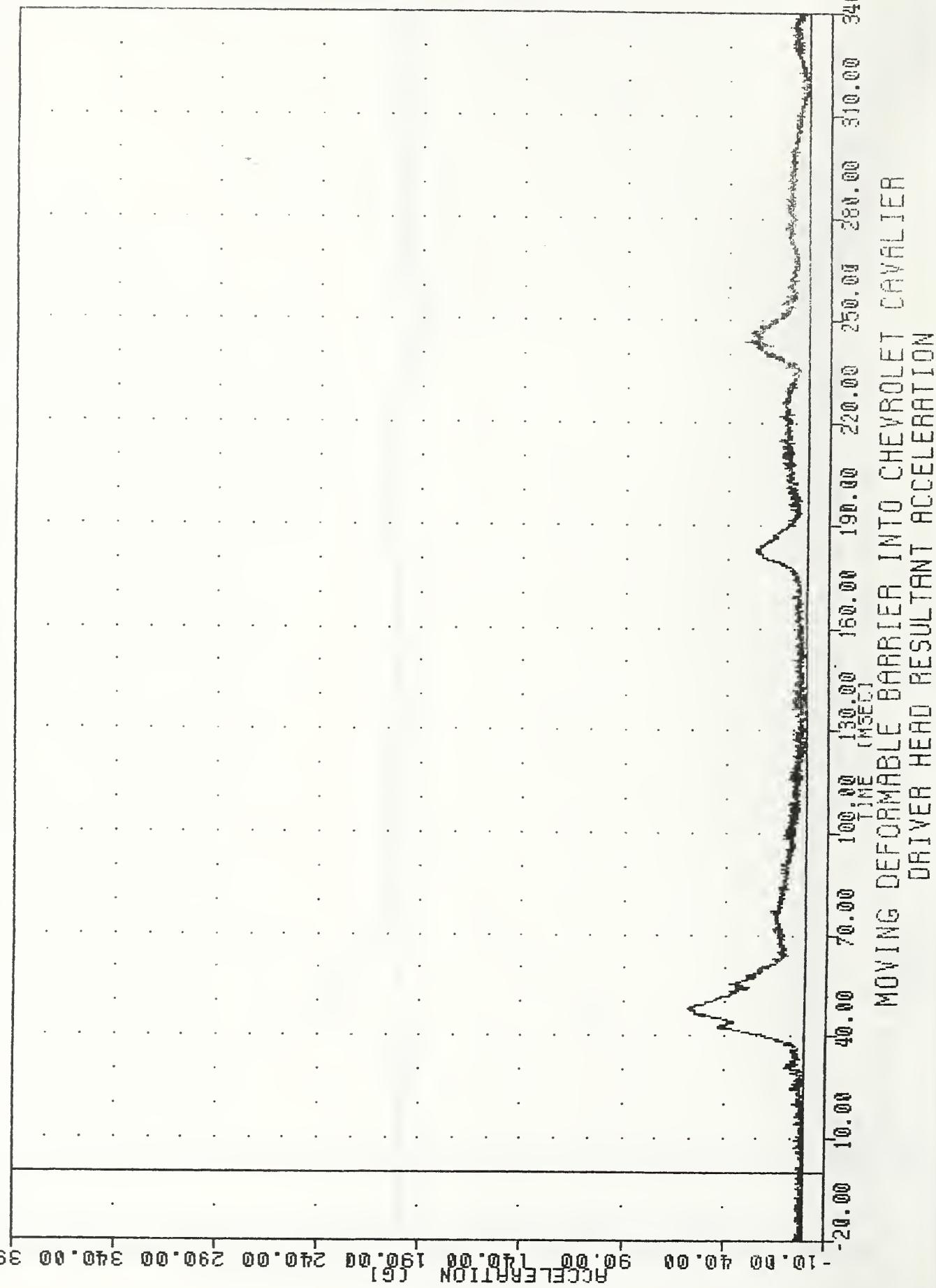
90154
SI PROTECTION PROD VEHICLE
HEDZ61

900604
FILTER = RLFF 1850/ 5214/ -40
MIN, MAX VALUES = -49.368 , 46.63 , 18.72 & 243.88



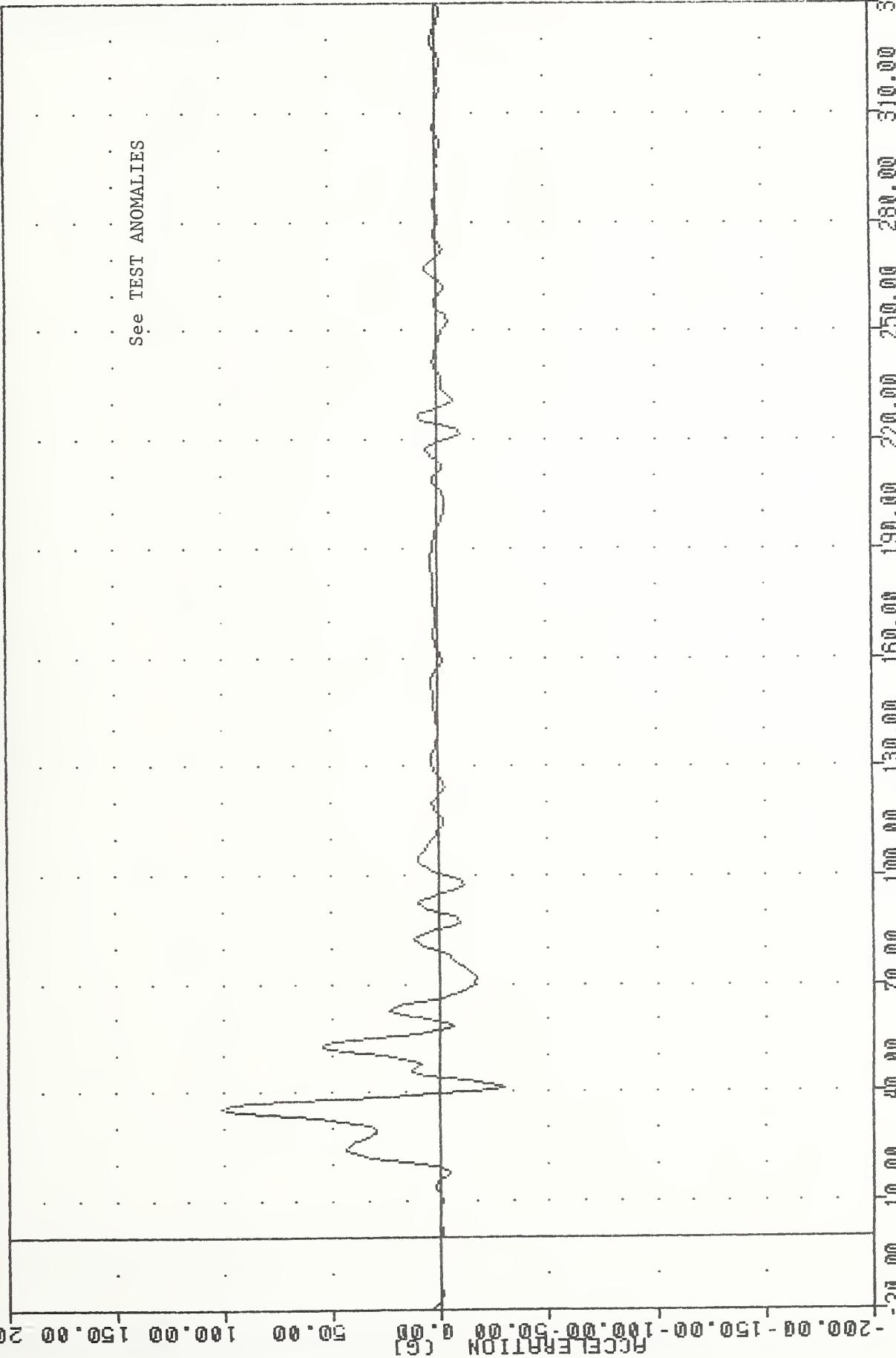
YRTC 900604
SI PROTECTION PROD VEHICLE
90154
HEDRG1

FILTER = ALPF 1650/
MIN, MAX VALUES = 0.420 -1.75 , 57.98 & 47.68



YRTC 900004
SI PROTECTION PROD VEHICLE
90154 SHLY61

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -29.888 41.25 . 100.78 @ 35.63

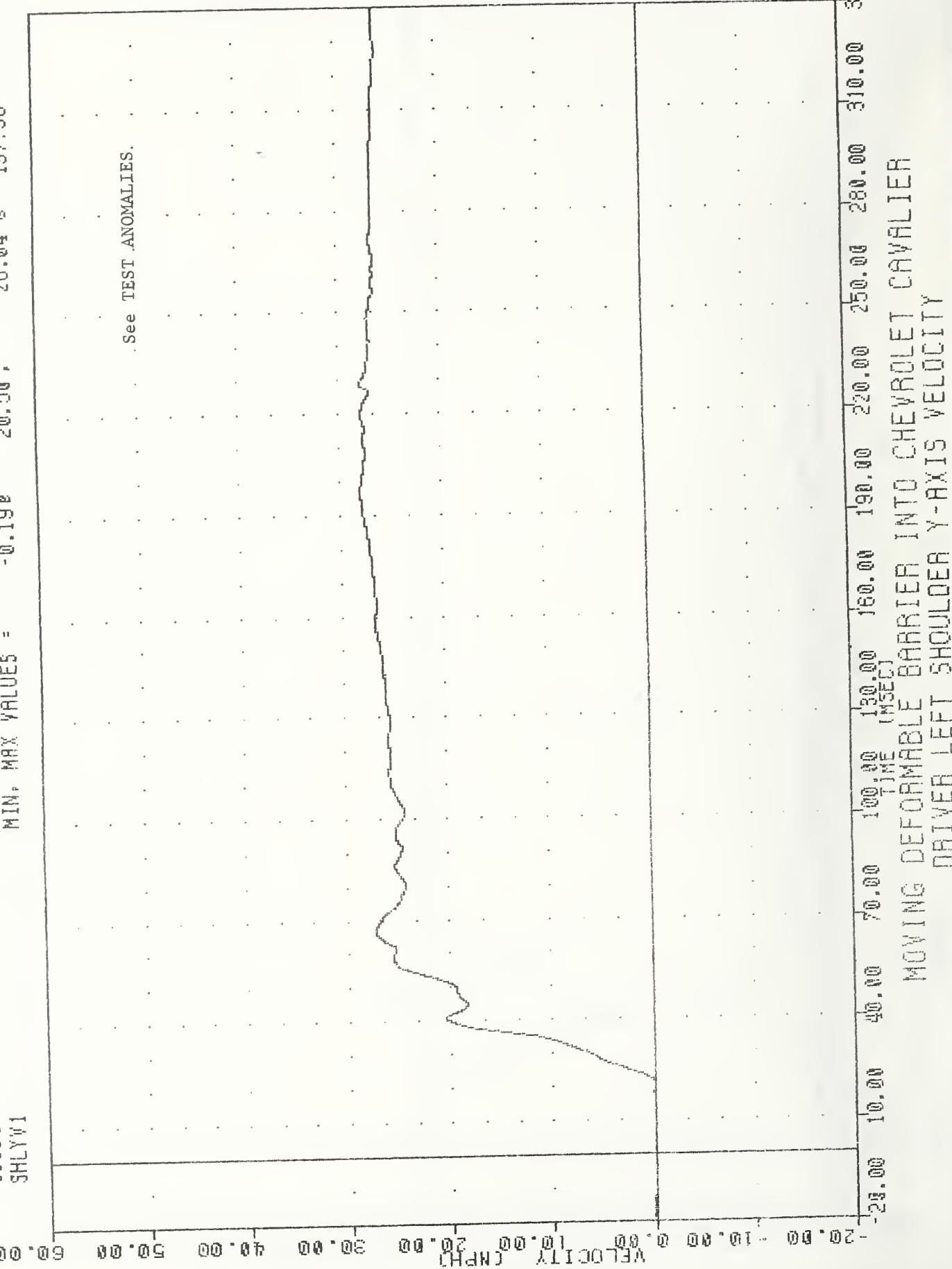


-200.00 -150.00 -100.00 -50.00 0.00 50.00 100.00 150.00 200.00
ACCELERATION (G)
0.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
TIME (MSEC)
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
DRIVER LEFT SHOULDER Y AXIS ACCELERATION

990154 SHELLI
WATC , SN00001
SSI PROTECTION PROD VEHICLE

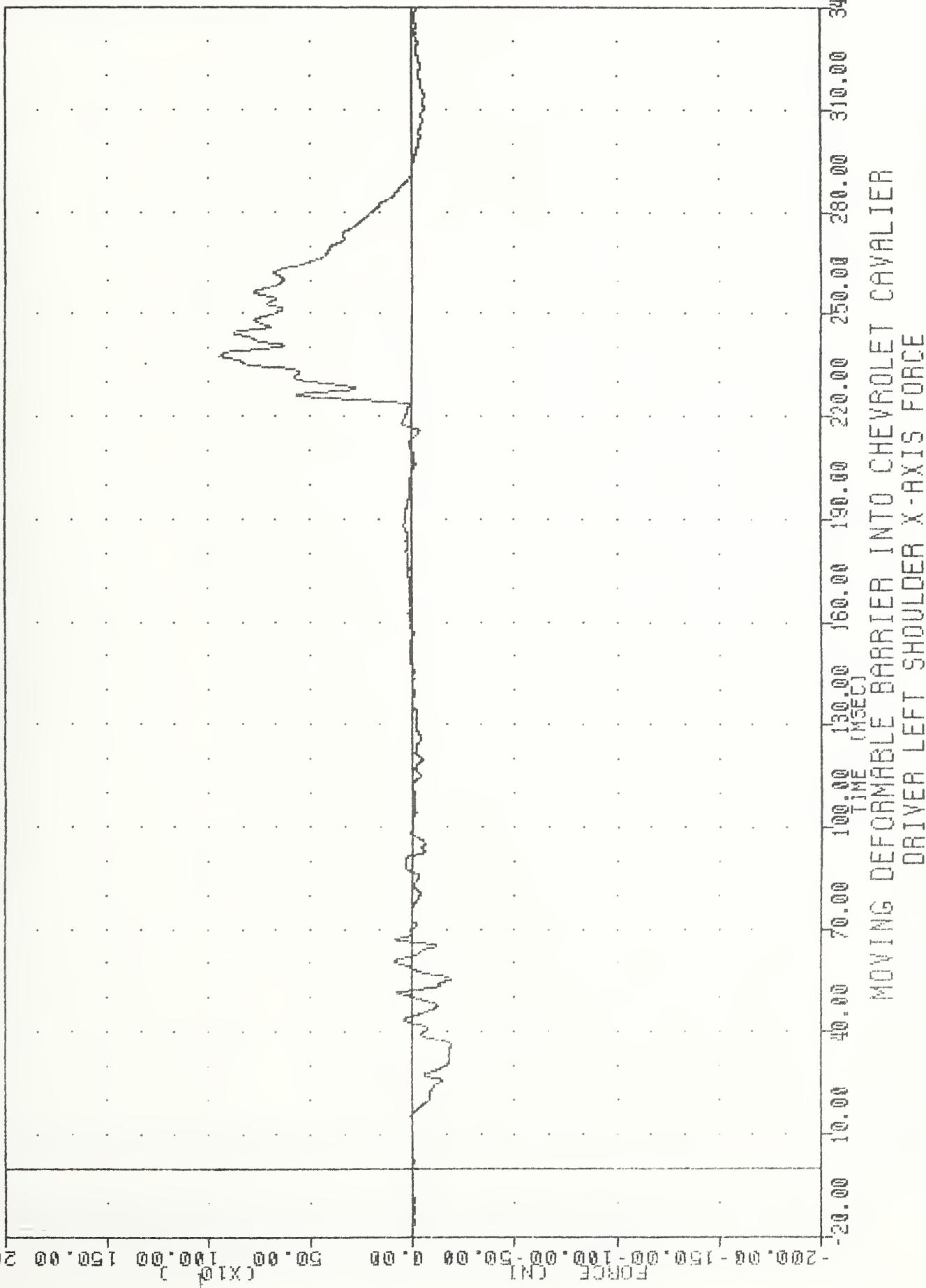
FILTER = ELPF 300/ 949/-40
MIN. MAX VALUES = -0.19e - 0.19e
28.04 8 197.38

See TEST ANOMALIES.



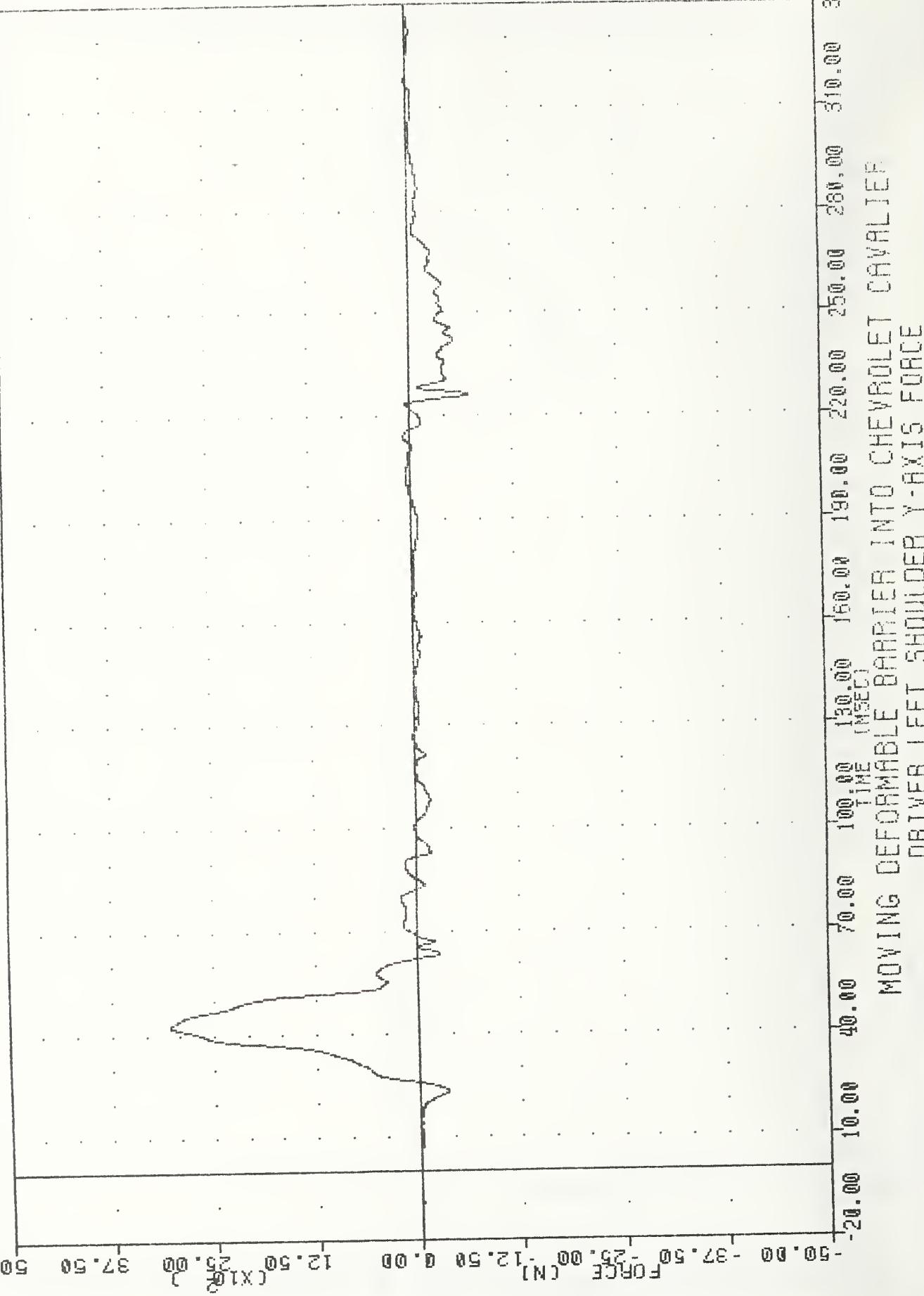
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
SHLXF1

FILTER = BLPF 300/ 945/-40
MIN, MAX VALUES = -193.38 55.50 . 941.40 8 237.75



YRTC , 900004
SI PROTECTION PROD VEHICLE
90154
SHLYF1

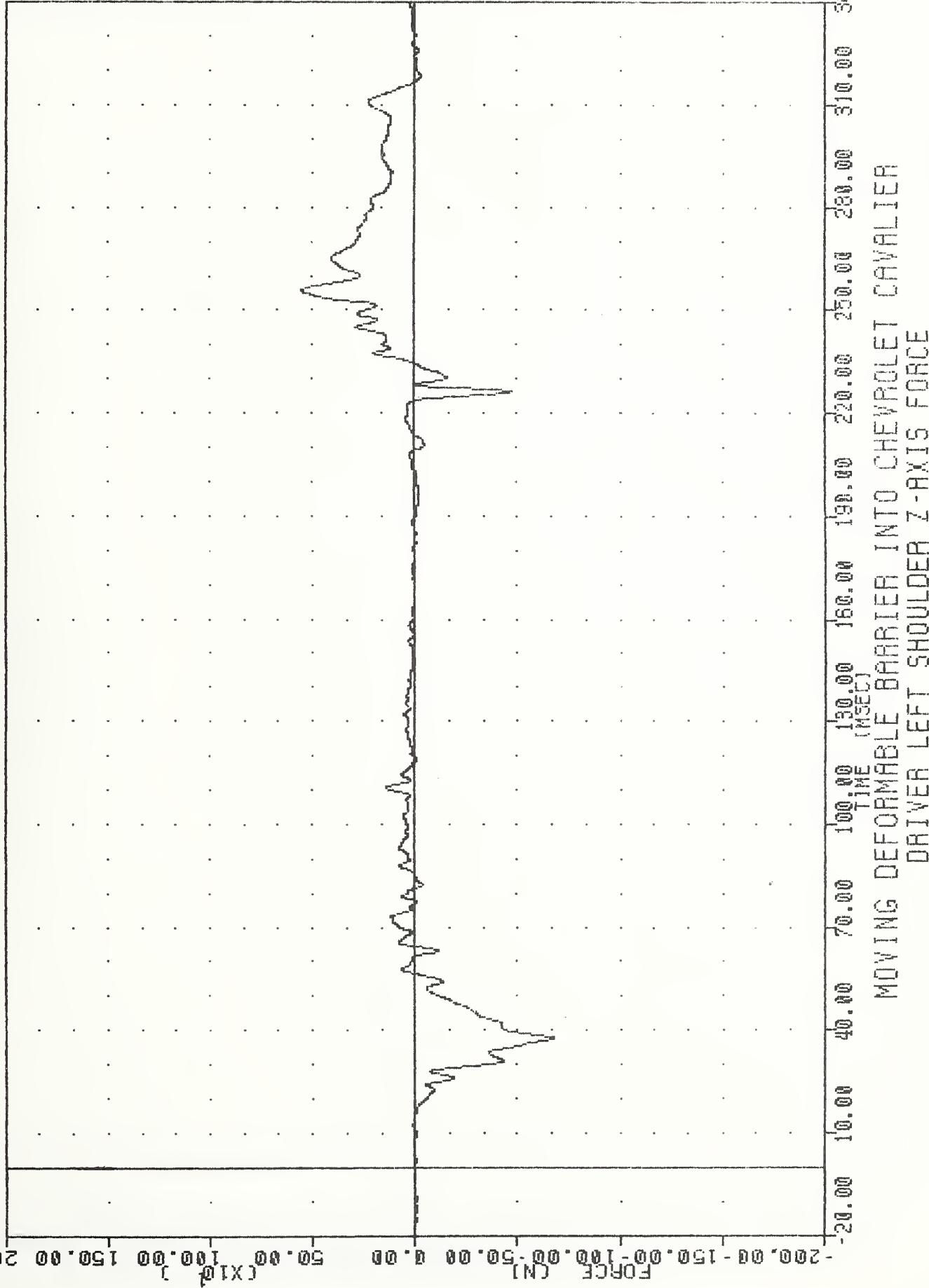
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -716.42 e 226.25 , 3034.03 e 42.75



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
DRIVER LEFT SHOULDER Y-AXIS FORCE

YRTC
SI PROTECTION PROD VEHICLE
90154
SHLZ1F1

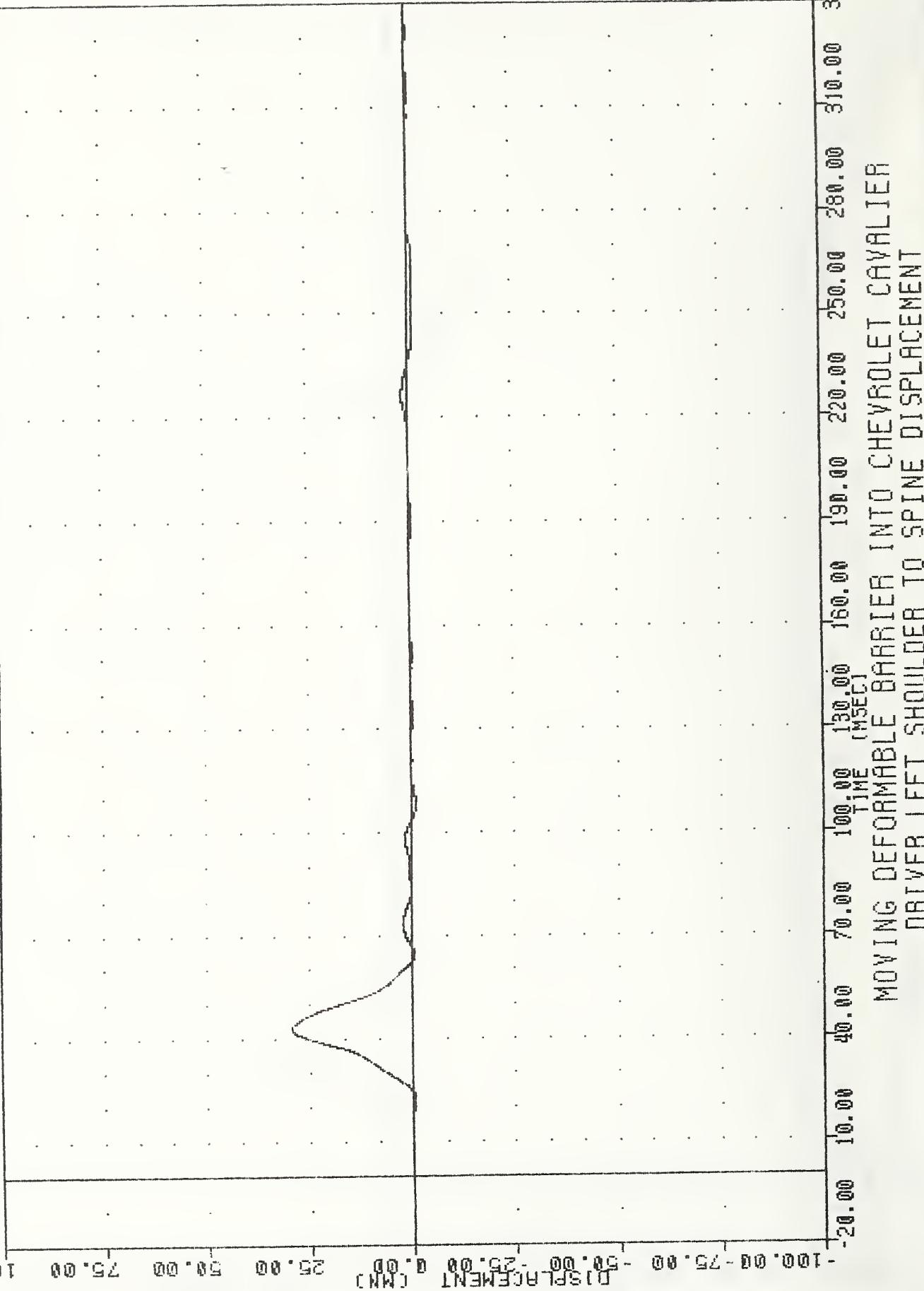
FILTER = BLPF 300/ 9491/-40
MIN, MAX VALUES = -678.038 37.63 , 549.59 & 255.75



WRTC
SI PROTECTION PROD VEHICLE
90154
SHLD1

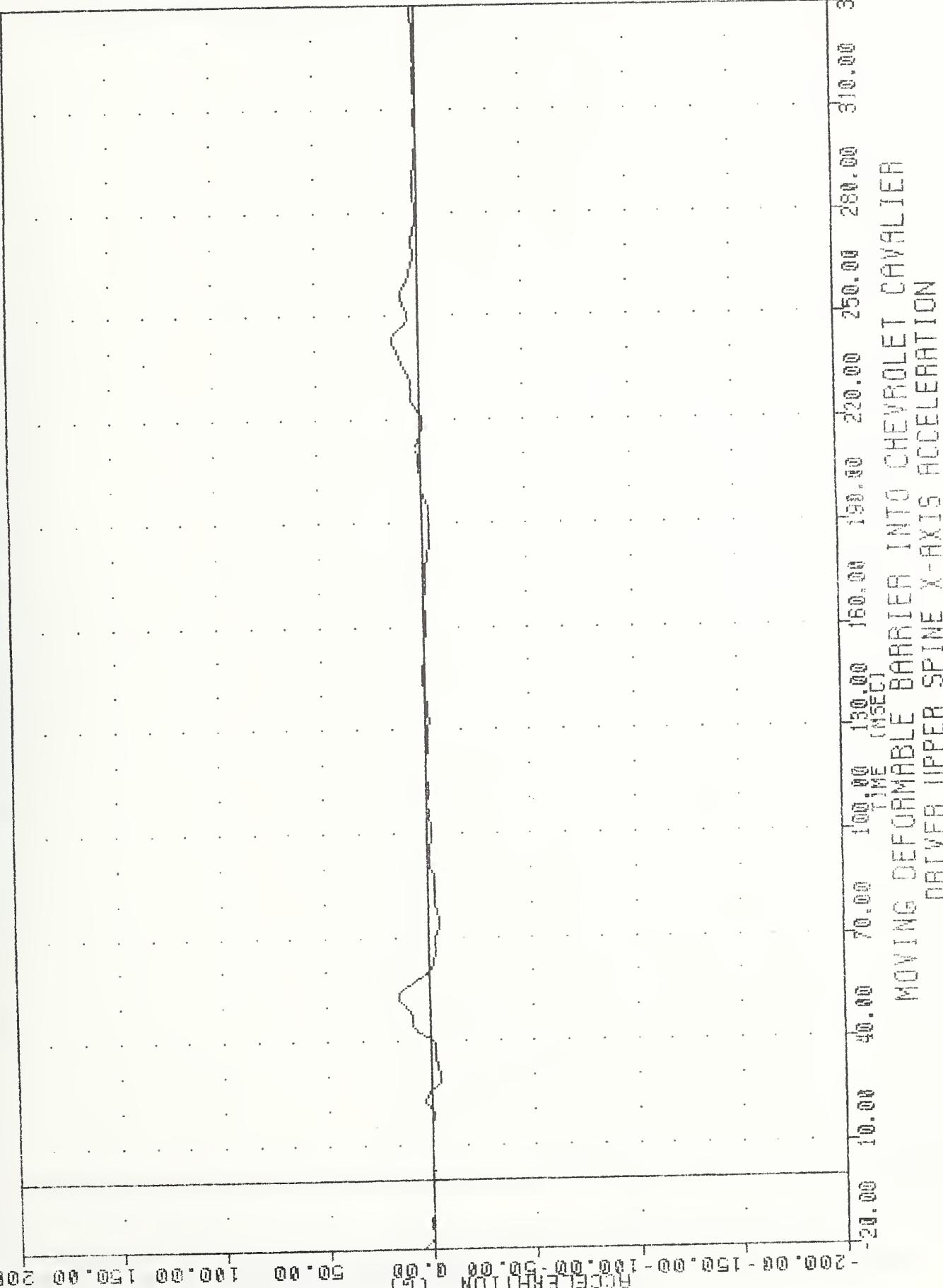
FILTER = BLPF 3000/ 949/ -40
MIN, MAX VALUES = -1.150 243.25 ,

29.51 @ 43.13



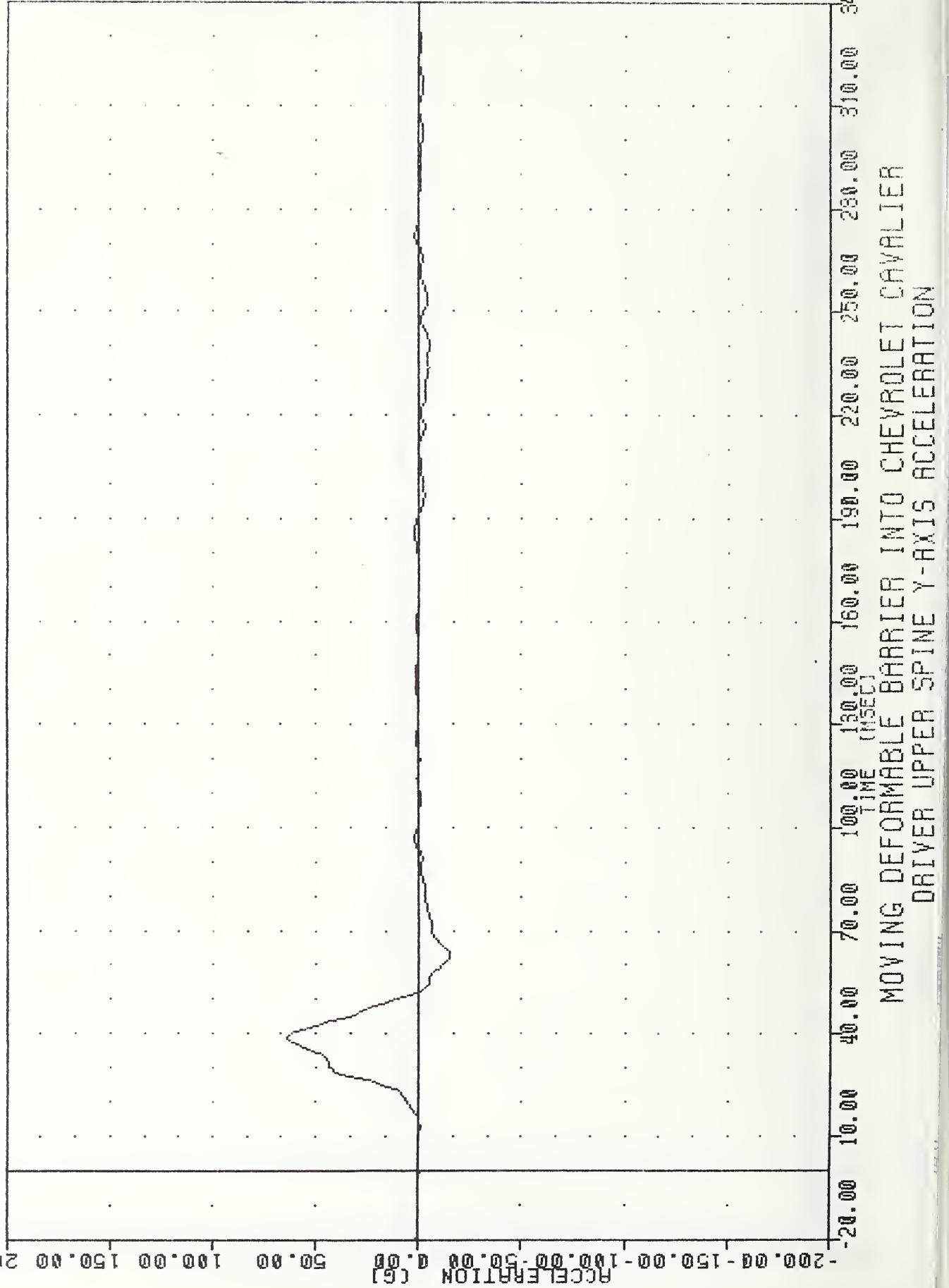
VRTC 9000604
SI PROTECTION PROD VEHICLE
30154 301X61

FILTER = HSPI 136/ 189/-50
MIN, MAX VALUES = -5.48E 74.37
15.61 8 52.50



YRTC
SI PROTECTION PROD VEHICLE
90154
101Y61

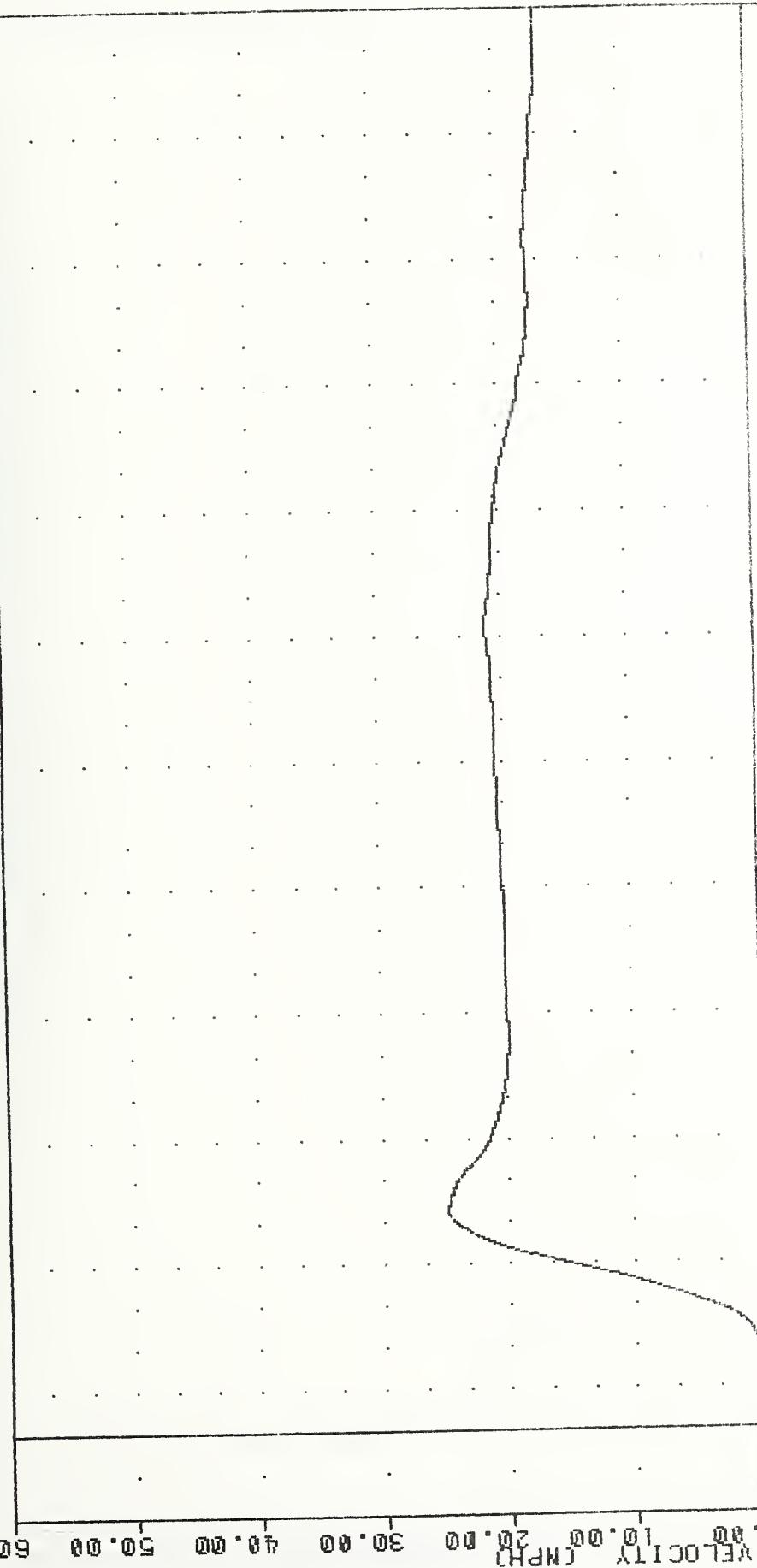
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -14.868 62.50 - 63.50 0 36.75



VRTC 900604
SI PROTECTION PROD VEHICLE
90154
TO1YV1

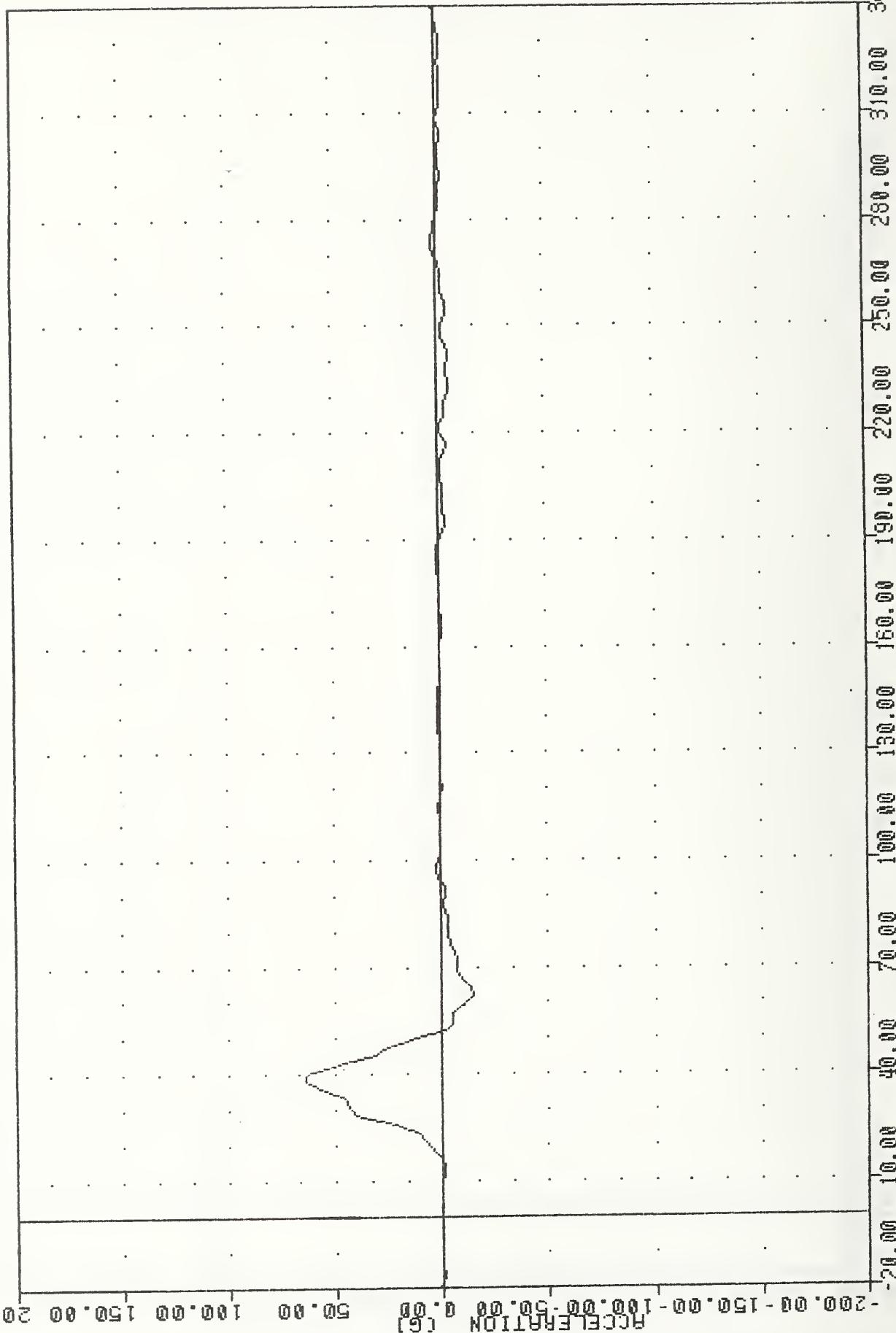
FILTER = BLFF 3000/ -40
MIN. MAX VALUES = 0.000 -20.00
24.88 2 52.63

Y-AXIS VELOCITY
DRIVER UPPER SPINE
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
TIME [MSECS]
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00



VRTC
SI PROTECTION PROD VEHICLE
9@154
T@1Y6A

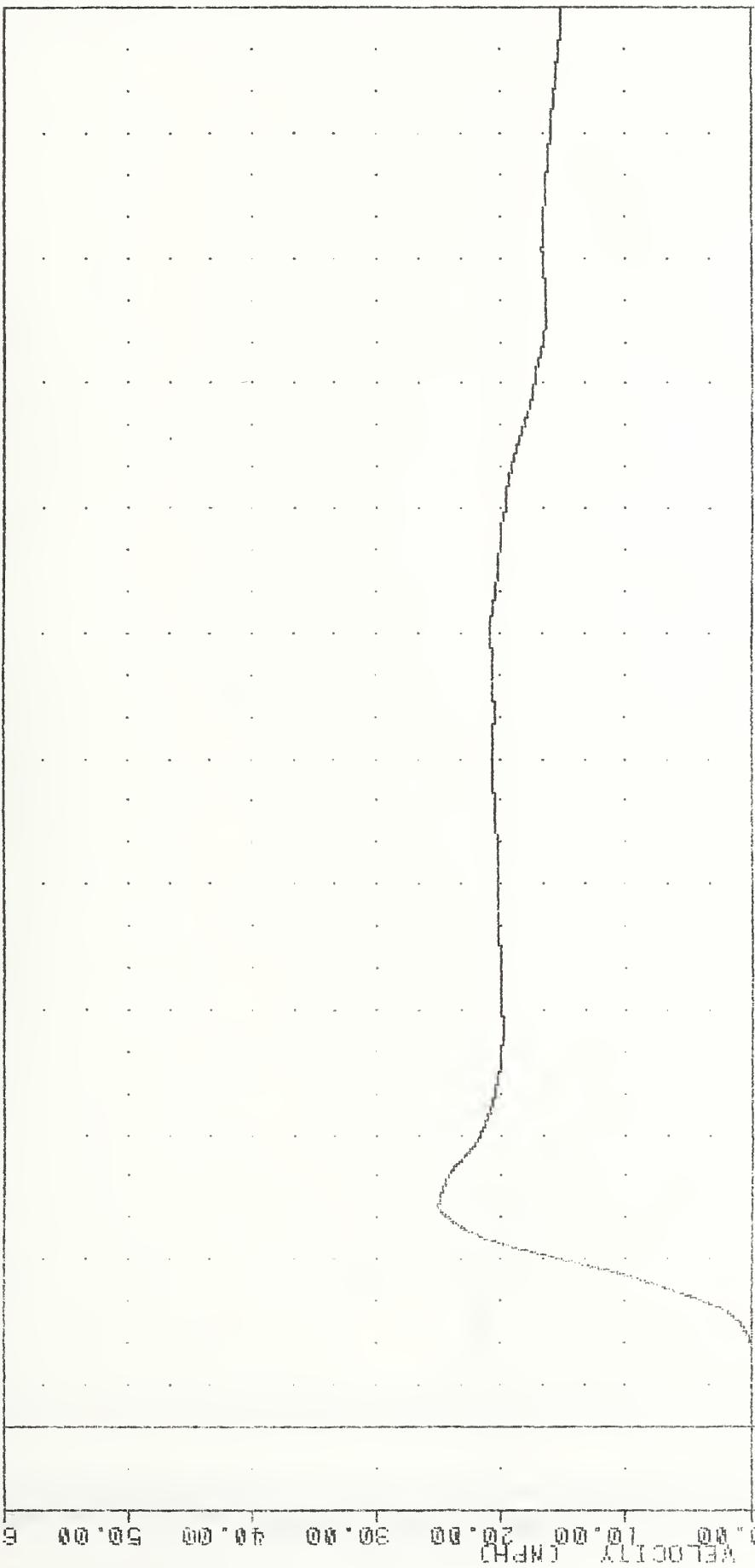
FILTER = HSRC 136/ 189/ -50
MIN. MAX VALUES = -14.35@ 62.5@ ,
64.1@ @ 38.75



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
DRIVER UPPER SPINE Y-AXIS REDUNDANT ACCELERATION

DRIVER SPINE Y-AXIS REDUNDANT VELOCITY

30.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00

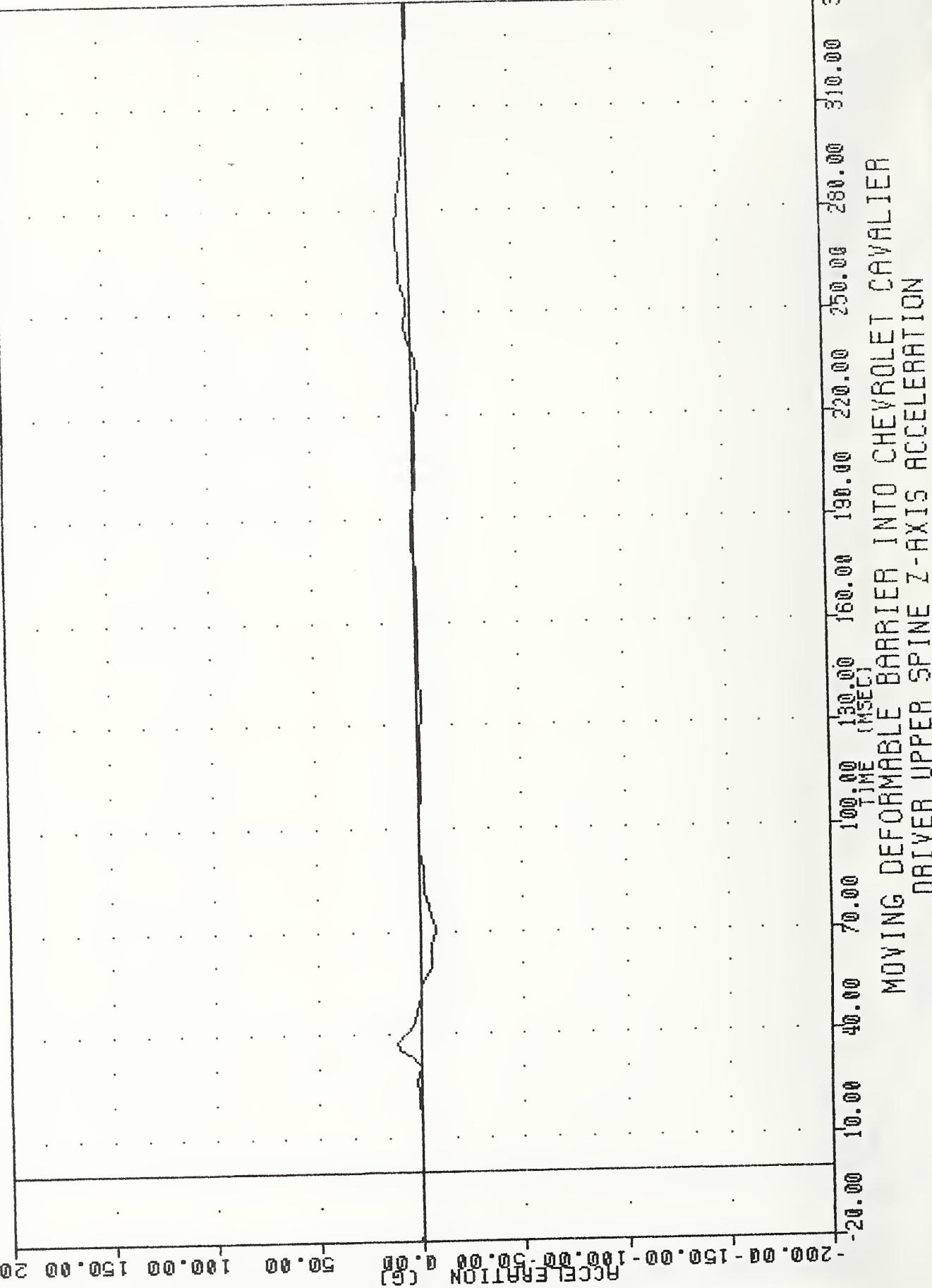


MIN, MAX VALUES = 10.13, 25.06 e 52.63
FILTER = BLPF 300/ -0.10 e 40
9054 FILTER = BLPF 300/ 349/-40

APTC, 90604
SI PROTECTION, PROG VEHICLE

YRTC 900604
SI PROTECTION PROD VEHICLE
90154
101761

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -6.95 70.63 11.69 0 36.86

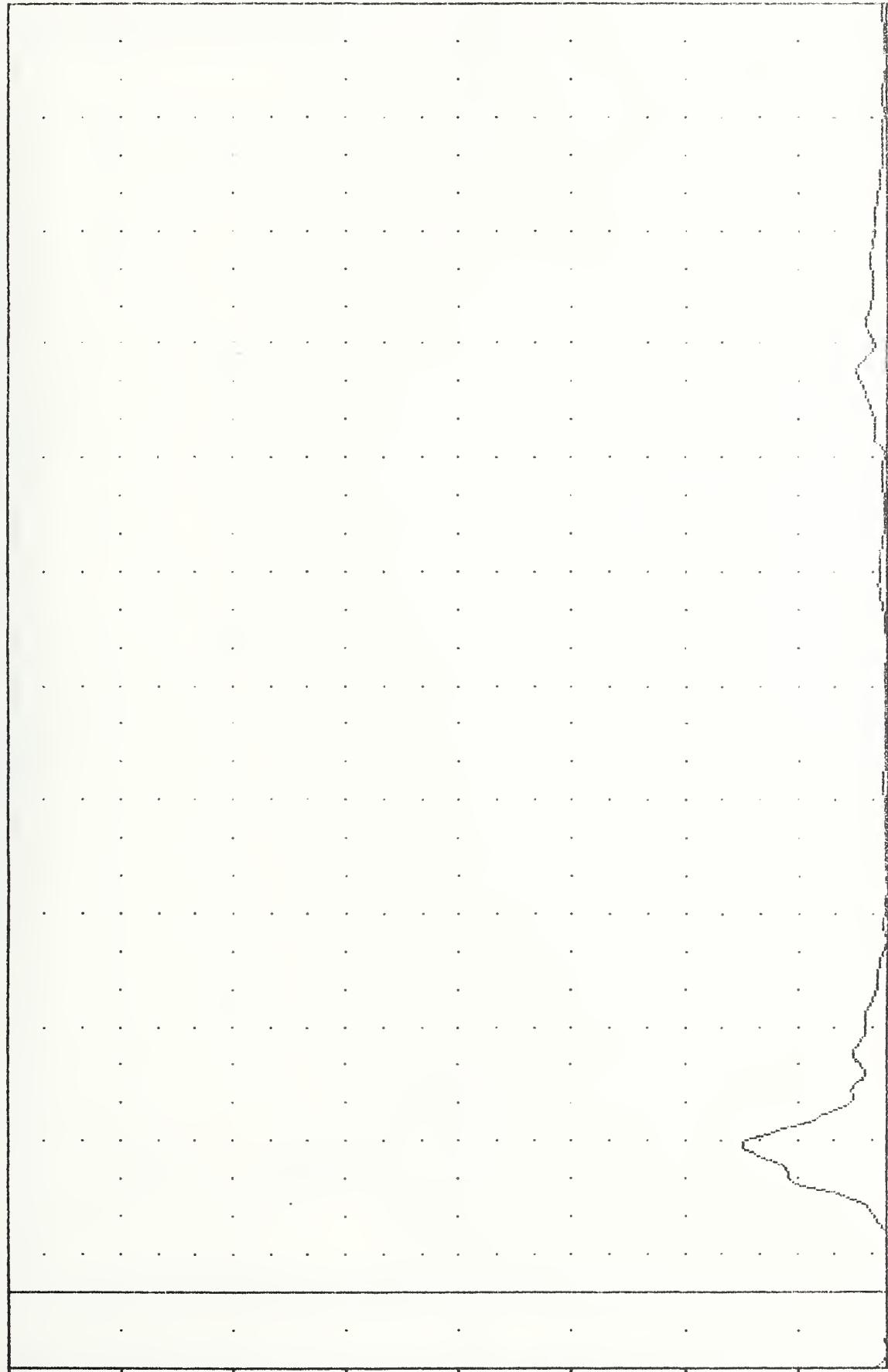


YRTC 900604
SI PROTECTION PROD VEHICLE
90154 101RG1

MIN. MAX VALUES = 0.058 8.75 , 64.34 @ 38.75

FILTER = HSPI 136/ 189/-50

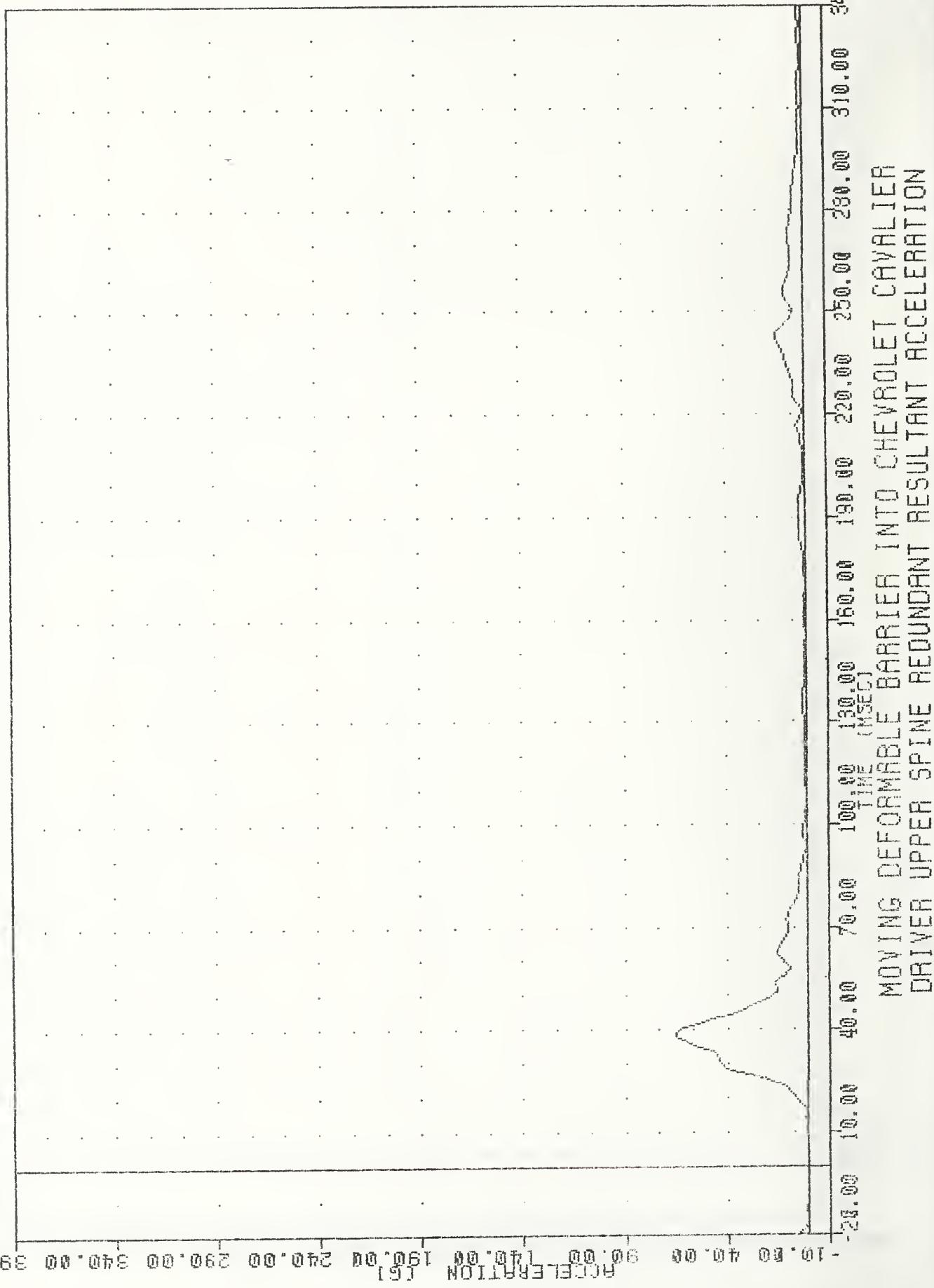
MIN. MAX VALUES = 0.058 8.75 , 64.34 @ 38.75



ACCELERATION (G) -20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
TIME (msec) 0.00 90.00 180.00 240.00 290.00 340.00 390.00
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
DRIVER UPPER SPINE RESULTANT ACCELERATION

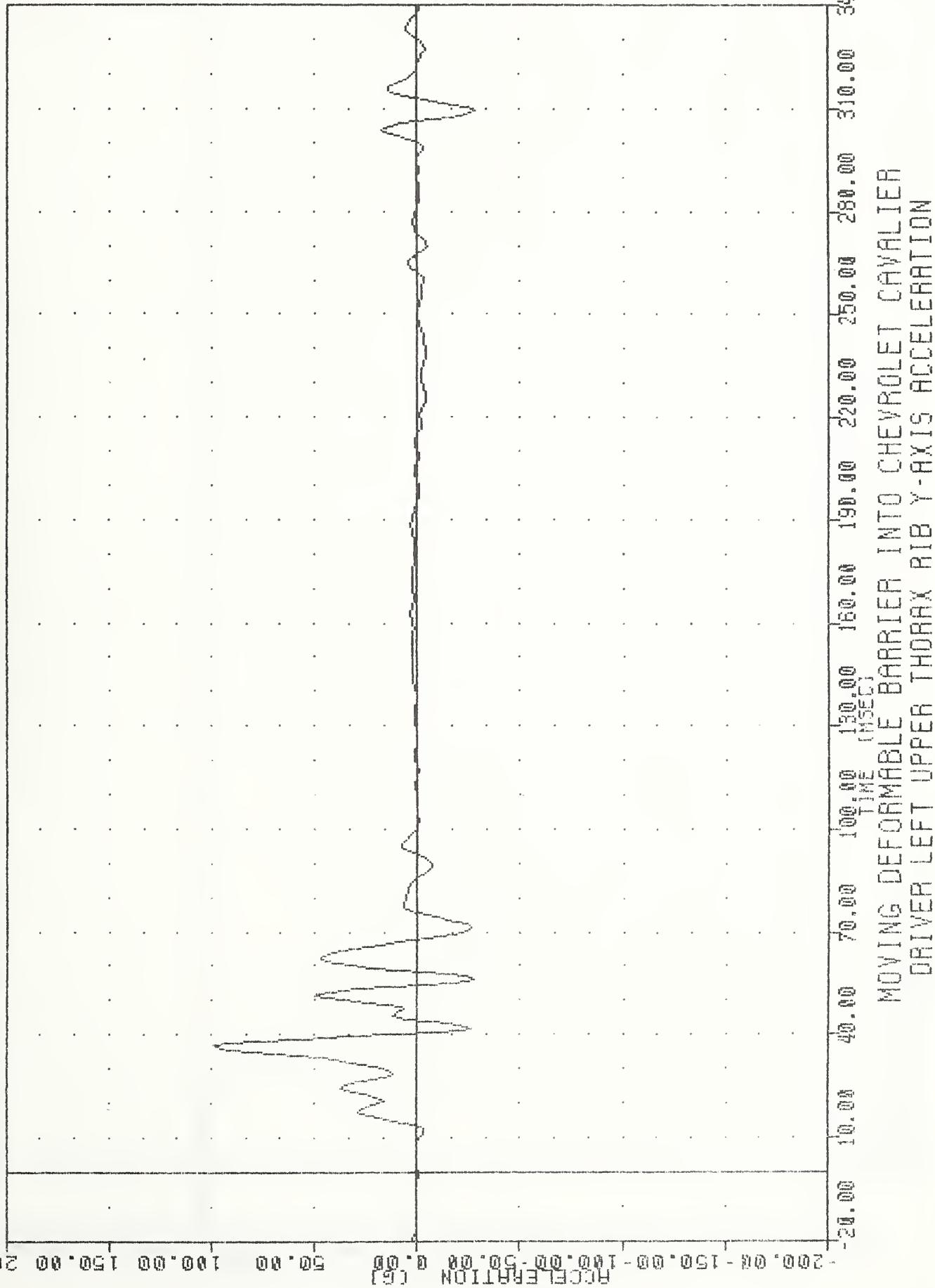
VRTEC
SI PROTECTION PROD VEHICLE
90154
TO TARGET

FILTER = HSRII 136/ 189/ -50
MIN. MAX VALUES = 0.048 9.37 , 64.94 & 38.75



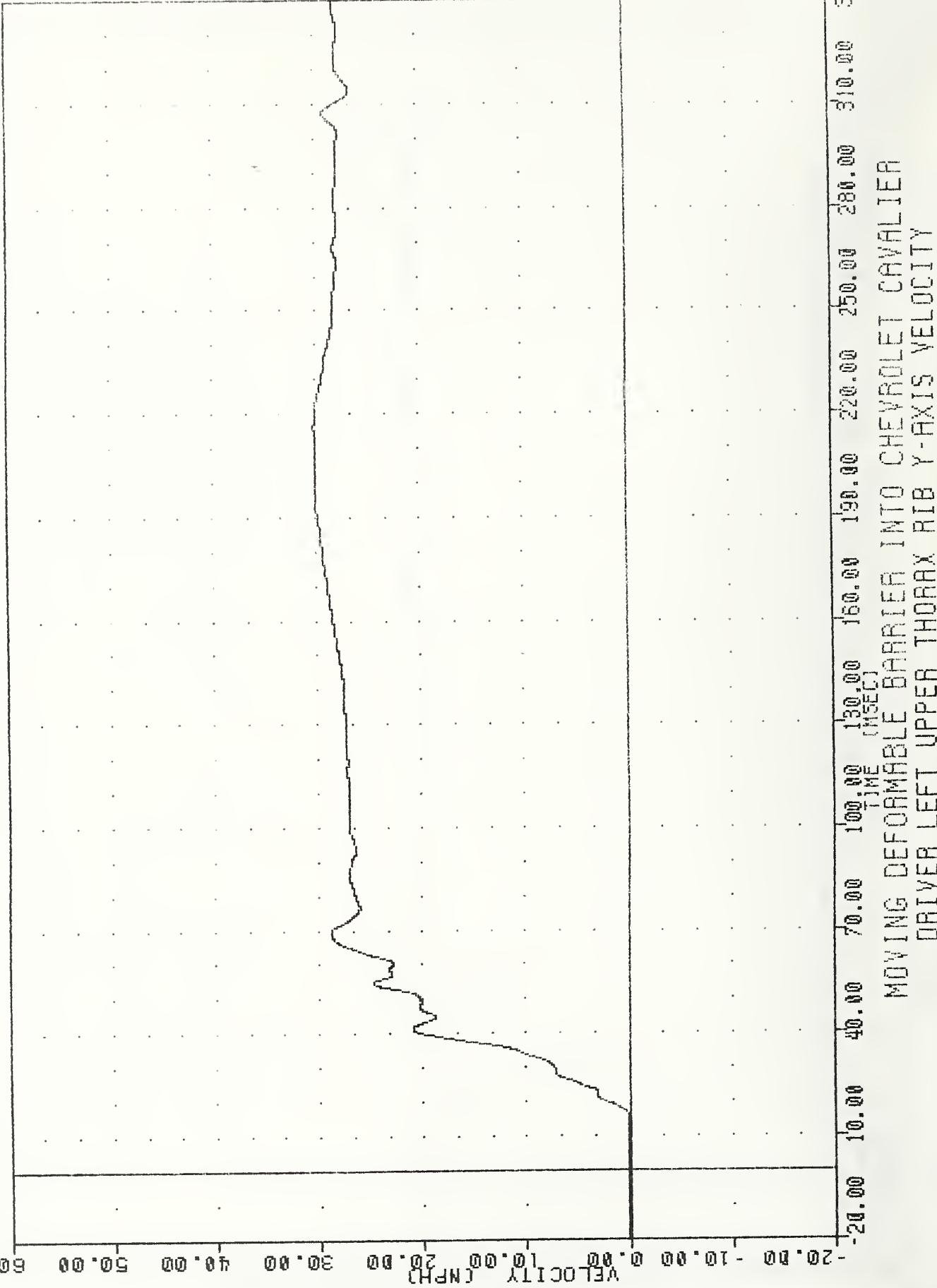
YRTC 900604
SI PROTECTION PROD VEHICLE
90154 LURY61

FILTER = HSFL 136/ 189/-50
MIN. MAX VALUES = -26.248 309.38 , 96.52 e 36.88



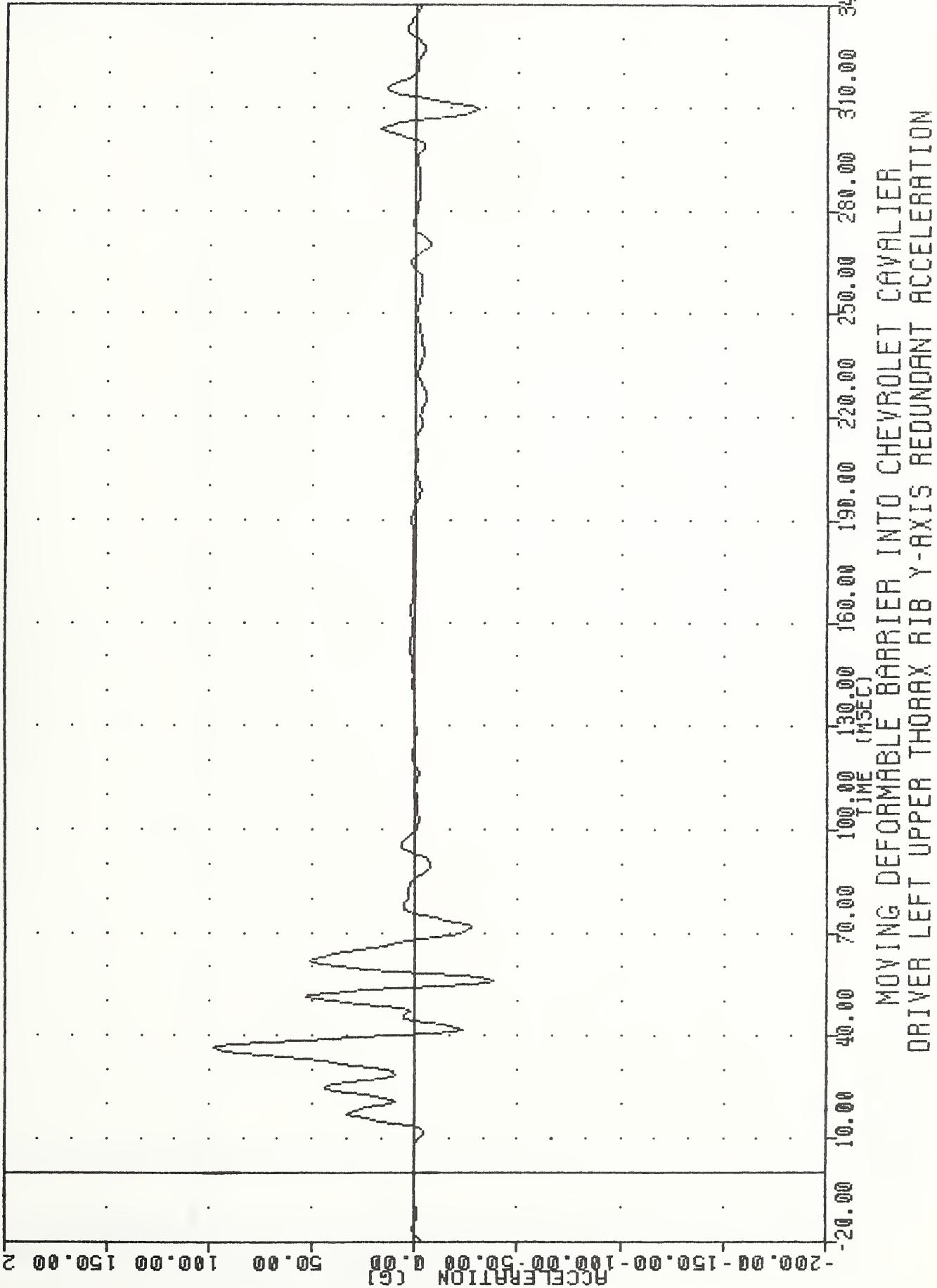
YATC
SI PROTECTION PROO VEHICLE
90154
LURV11

FILTER = BLFF 300/ 949/-40
MIN, MAX VALUES = 0.00e 0.00 -20.00 , 30.14 e 216.38



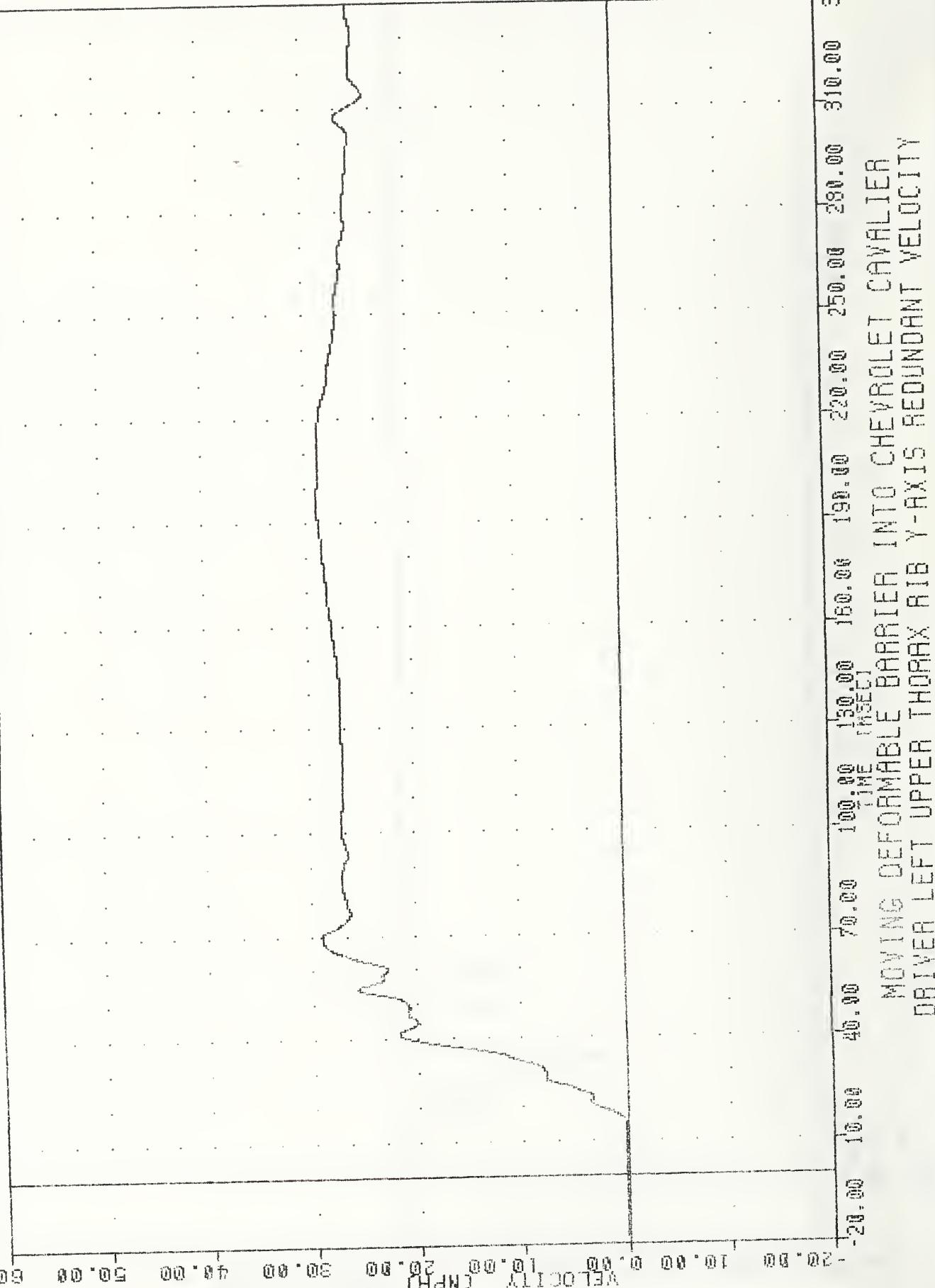
VRTC 900604
SI PROTECTION PROD VEHICLE
90154 LURIGA

FILTER = HSR1 136/ 189/ -50
MIN, MAX VALUES = -37.618 56.25 . 97.40 8 36.25



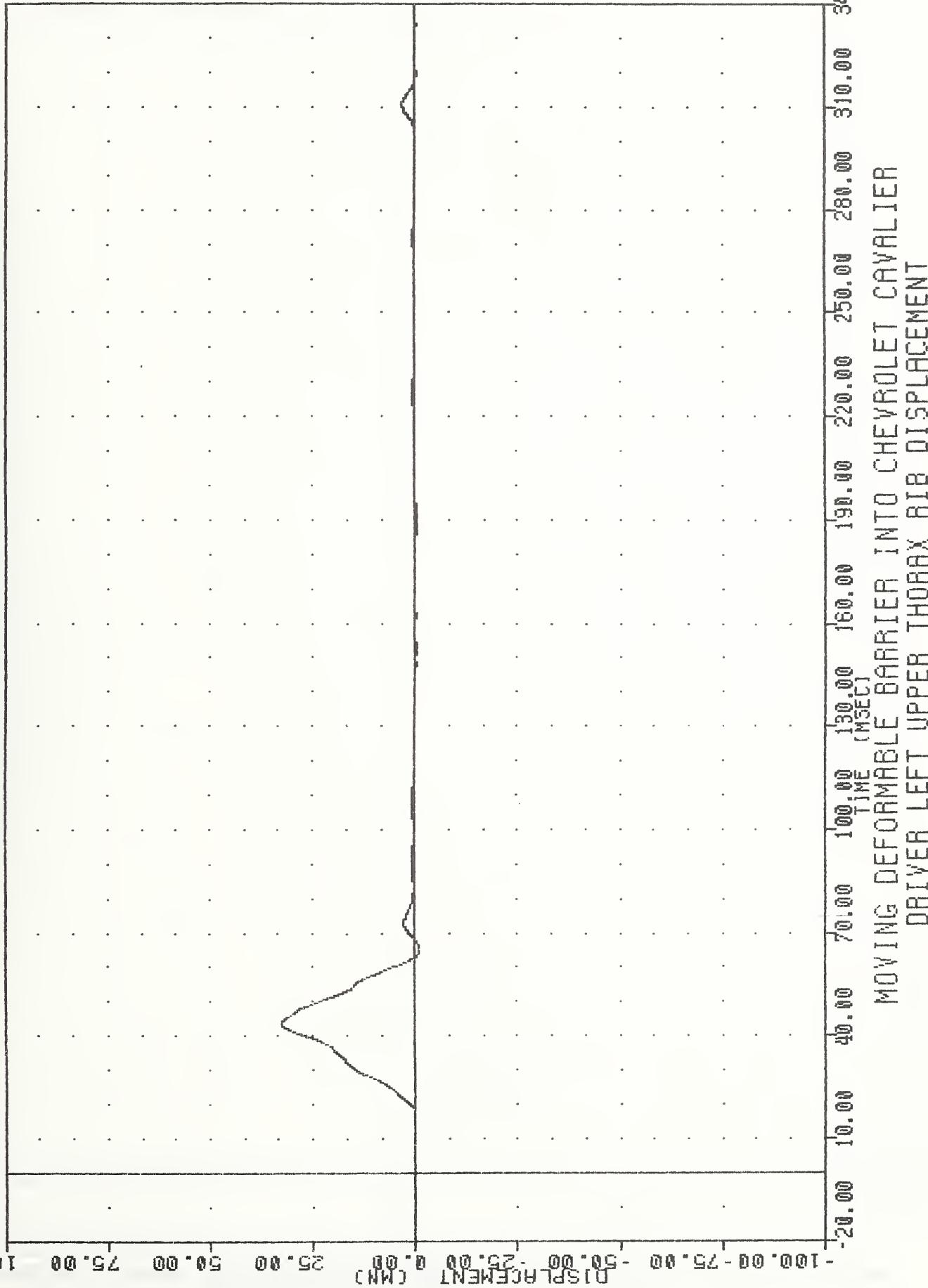
YRIC
SI PROTECTION PROD VEHICLE
90154
LURVIA

FILTER = BLPF 300/ 949/-40
MIN, MAX VALUES = 0.000 -20.00 , 29.07 8 69.88



90154
MTC 1 PROTECTION PROD VEHICLE
900604

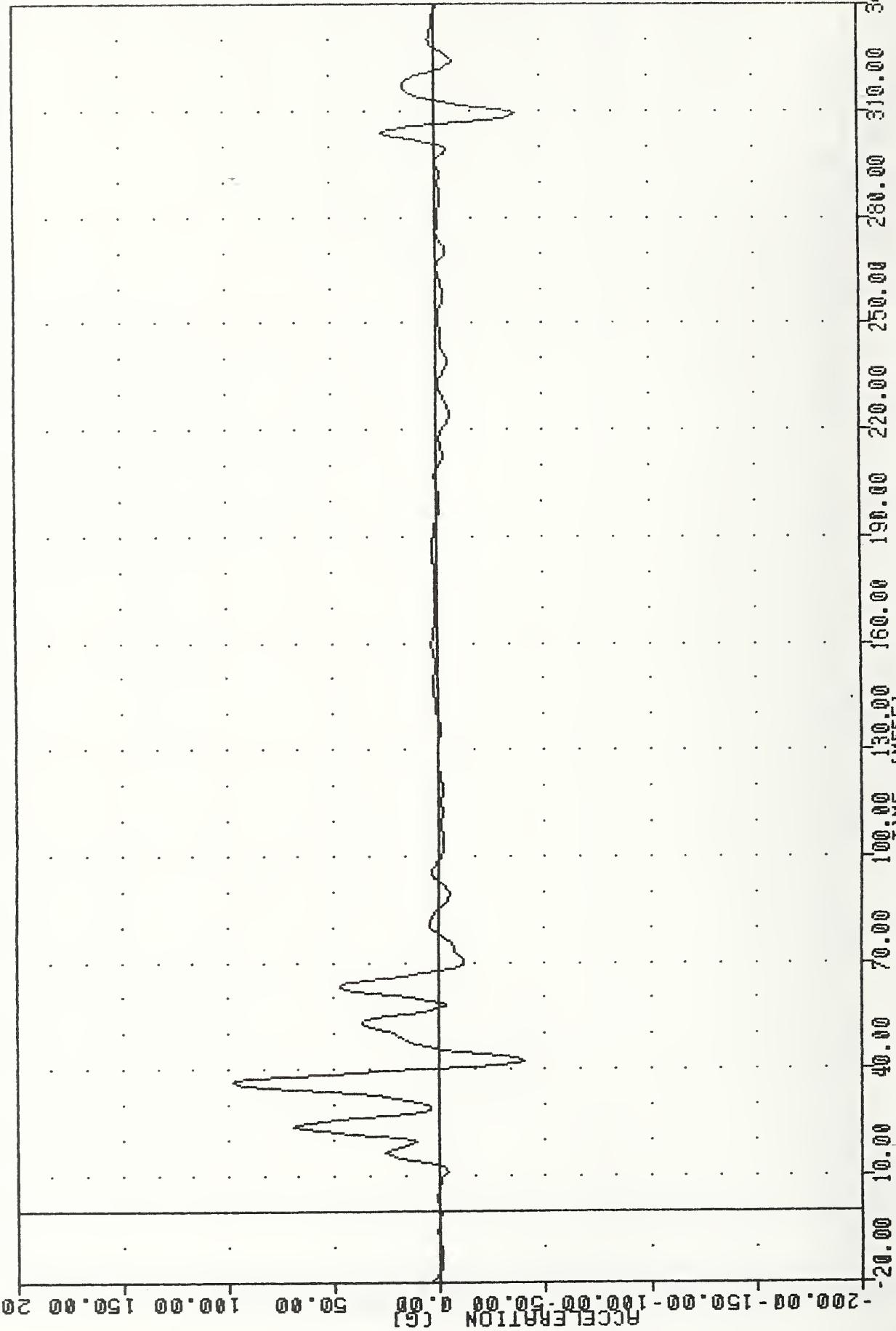
$$\text{FILTER} = \text{BLPF} \quad 300/\text{MIN. MAX VALUES} = \quad 949/-40 \quad -1.16e$$



YRTC
SI PROTECTION PROD VEHICLE
90154
LCRY61

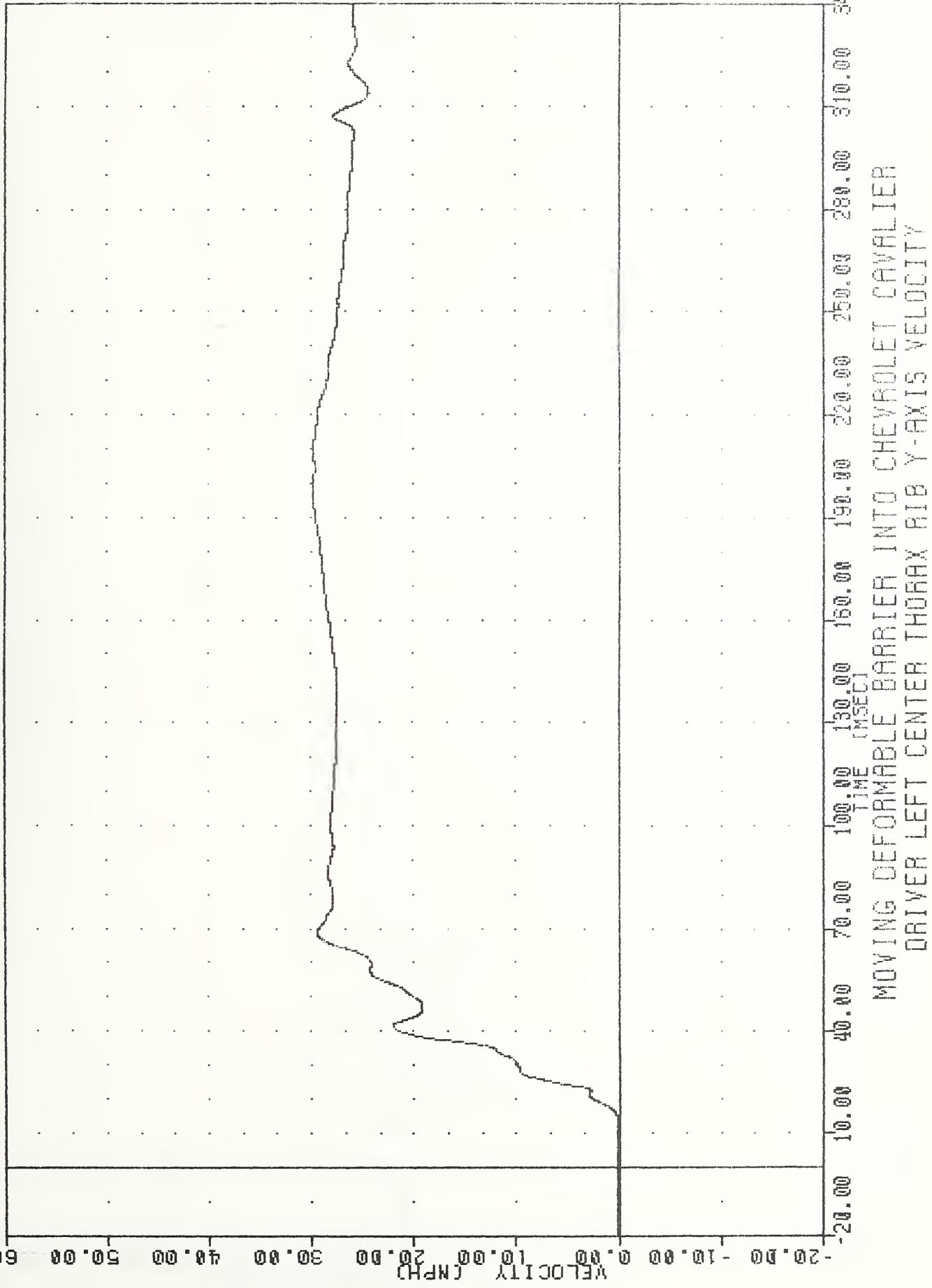
900604
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -39.538 42.50 ,

97.94 @ 36.25



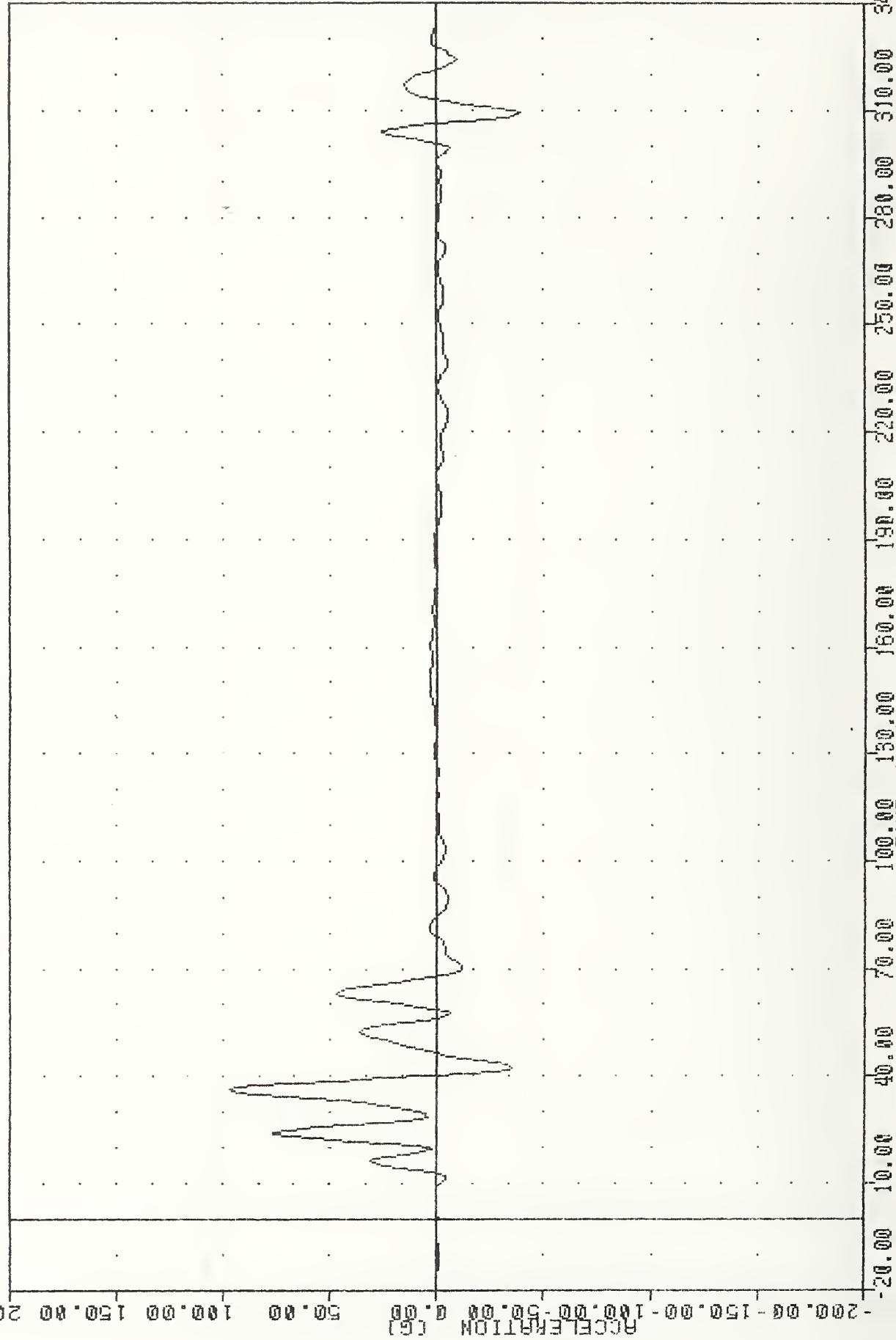
YATC 900604
SI PROTECTION PROD VEHICLE
90154
LCRYW1

FILTER = BLPF 300/ 949/-40
MIN, MAX VALUES = 0.00e -20.00 , 29.79 e 197.75



VRTC
SI PROTECTION PROD VEHICLE
90154
LCRYGA

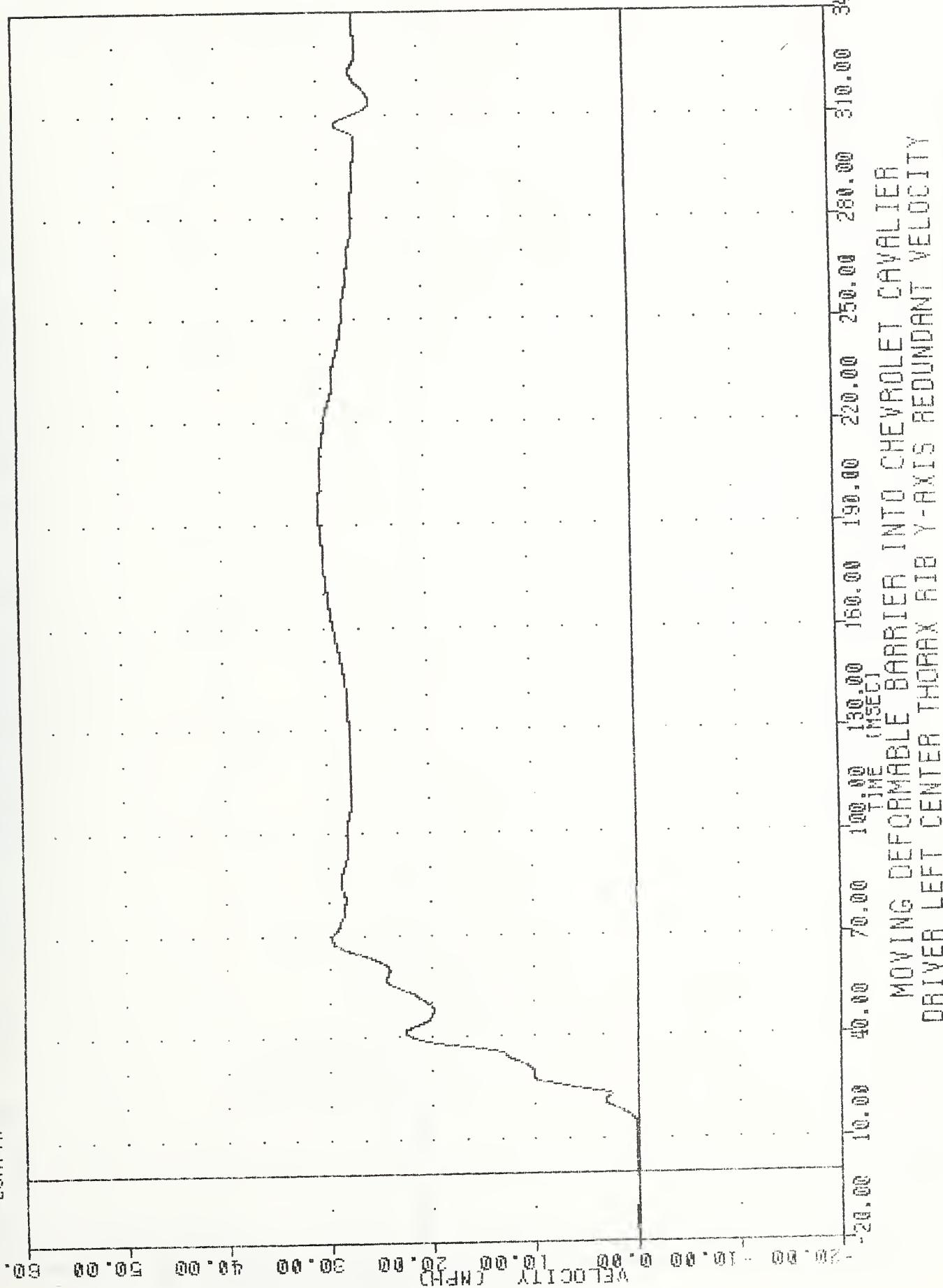
FILTER = HSRII 136/ 189/ -50
MIN, MAX VALUES = -38.450 309.38 , 96.95 @ 36.25



Moving deformable barrier into Chevrolet Cavalier
Driver left center thorax rib Y-axis redundant acceleration

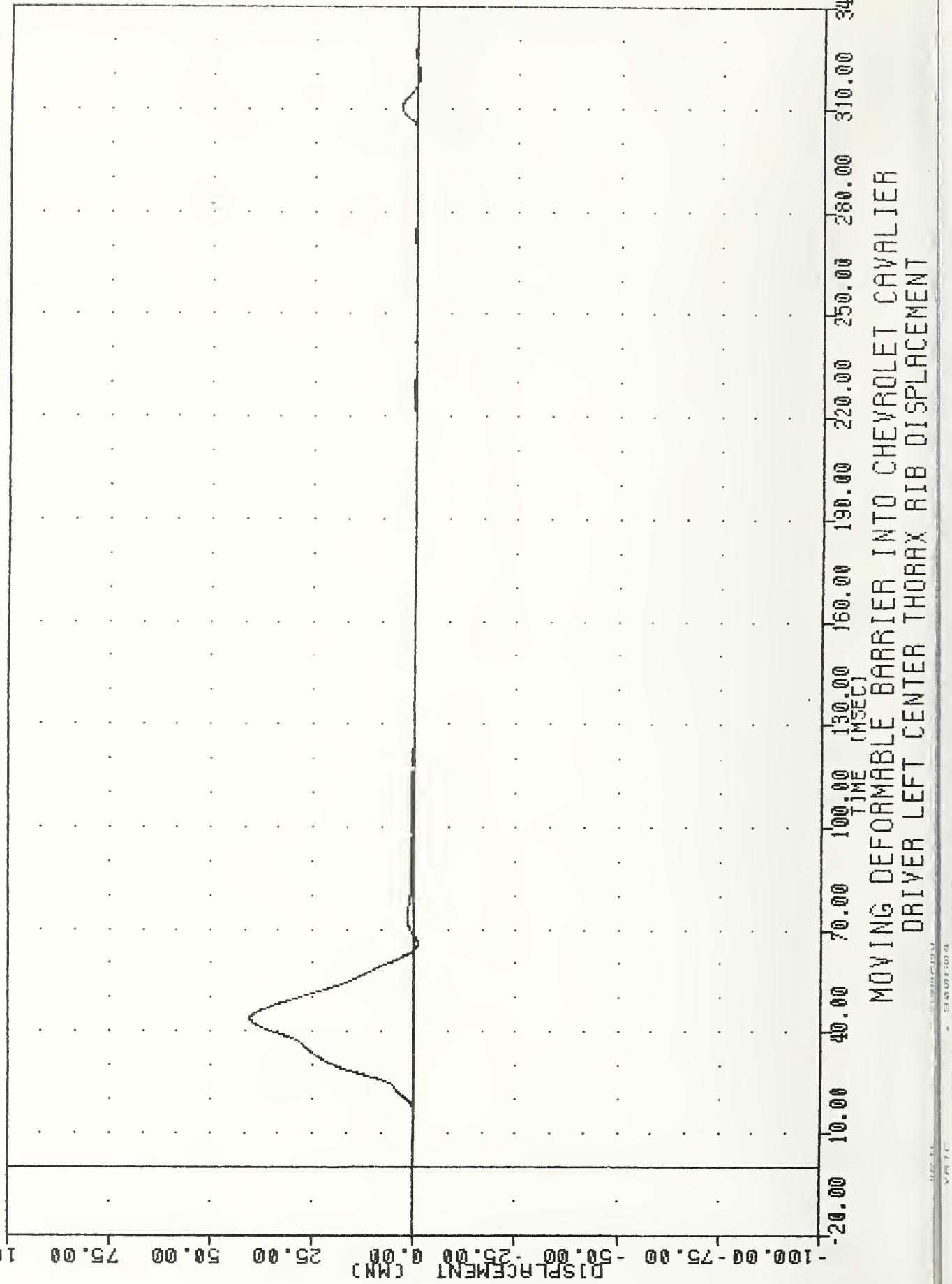
YRTC
SI PROTECTION PASS VEHICLE
90154
LCRIVW

FILTER = BLFF 300/ 949/ -40
MIN, MAX VALUES = -0.042 -6.13 , 30.45 & 195.63



90154
900604
S1 PROTECTION, PROD0 VEHICLE
LCRY01

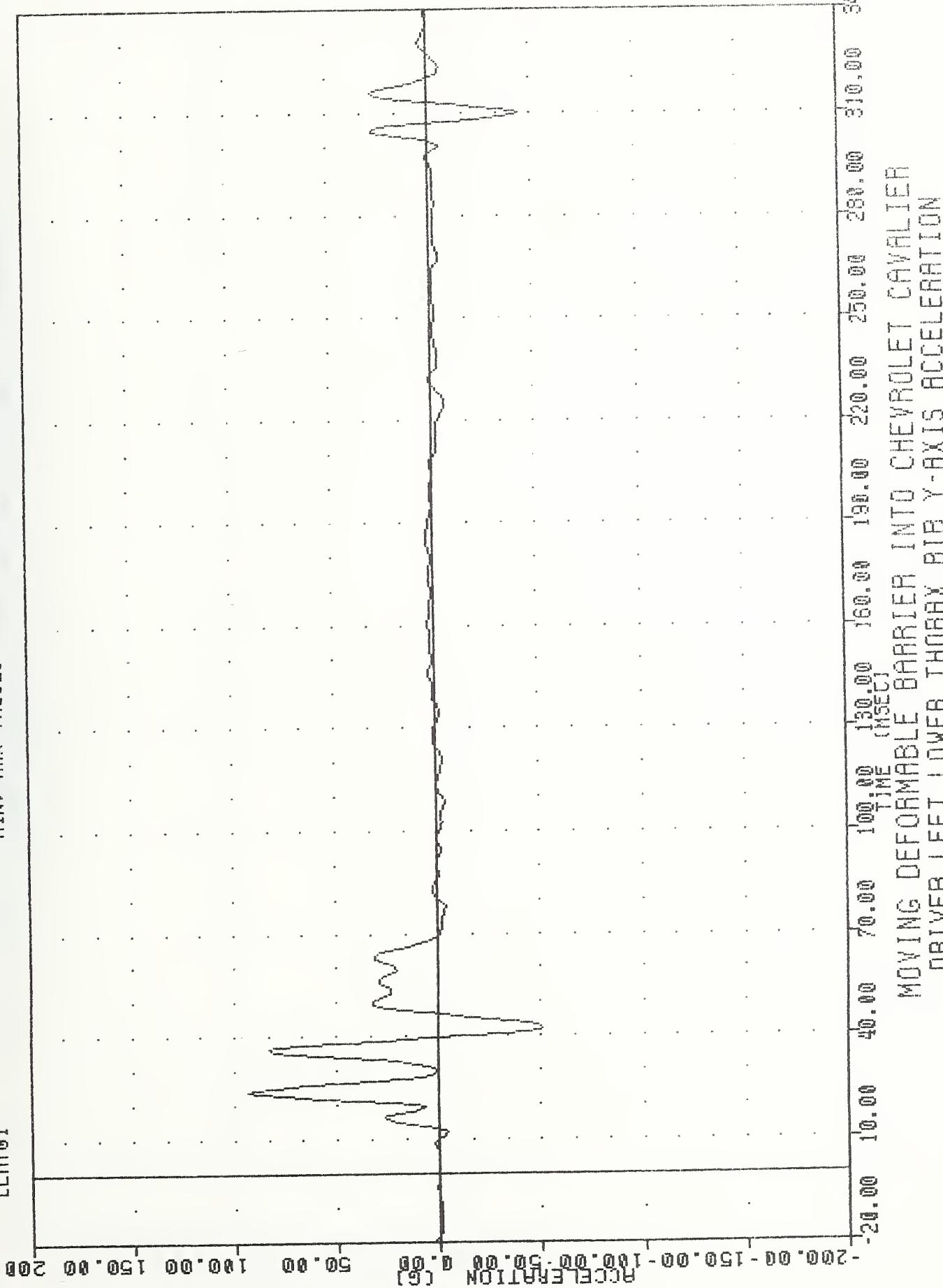
FILTER = BLPF 3000/ 949/ -40
MIN, MAX VALUES = -0.750 65.75 , 40.33 & 43.75



900604
SI PROTECTION PHD VEHICLE
90154
LLA91

FILTER = HSRI 136/ 189/-50
MIN. MAX VALUES = -50.938 42.500
93.568 23.75

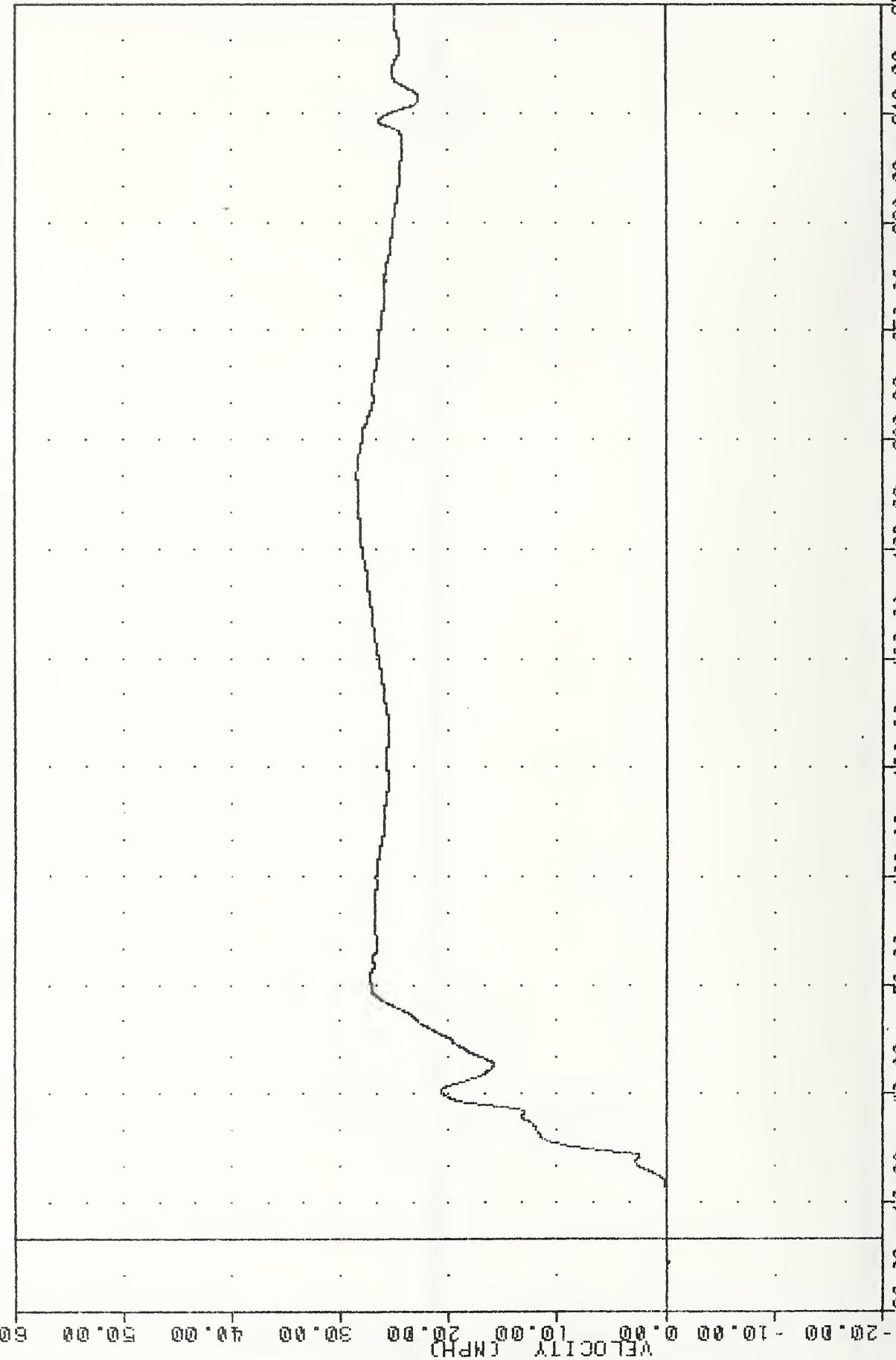
900604
SI PROTECTION PHD VEHICLE
90154
LLA91



YRTC , 900604
SI PROTECTION PROD VEHICLE
90154
LLRYV1

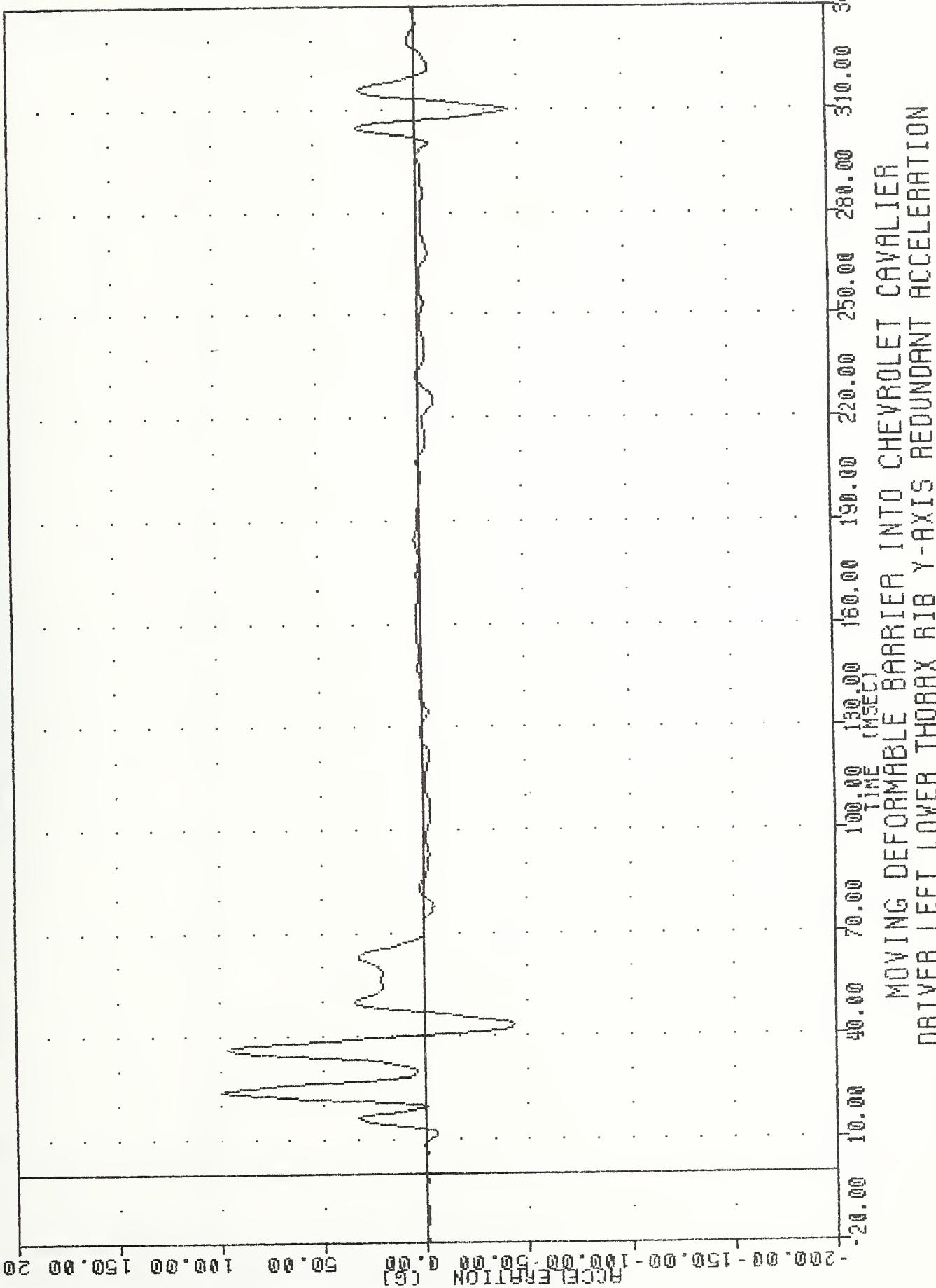
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.208 -6.75 ,
28.45 & 210.13

-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00



YRTC 900604
SI PROTECTION PROD VEHICLE
9@154
LLRYGA

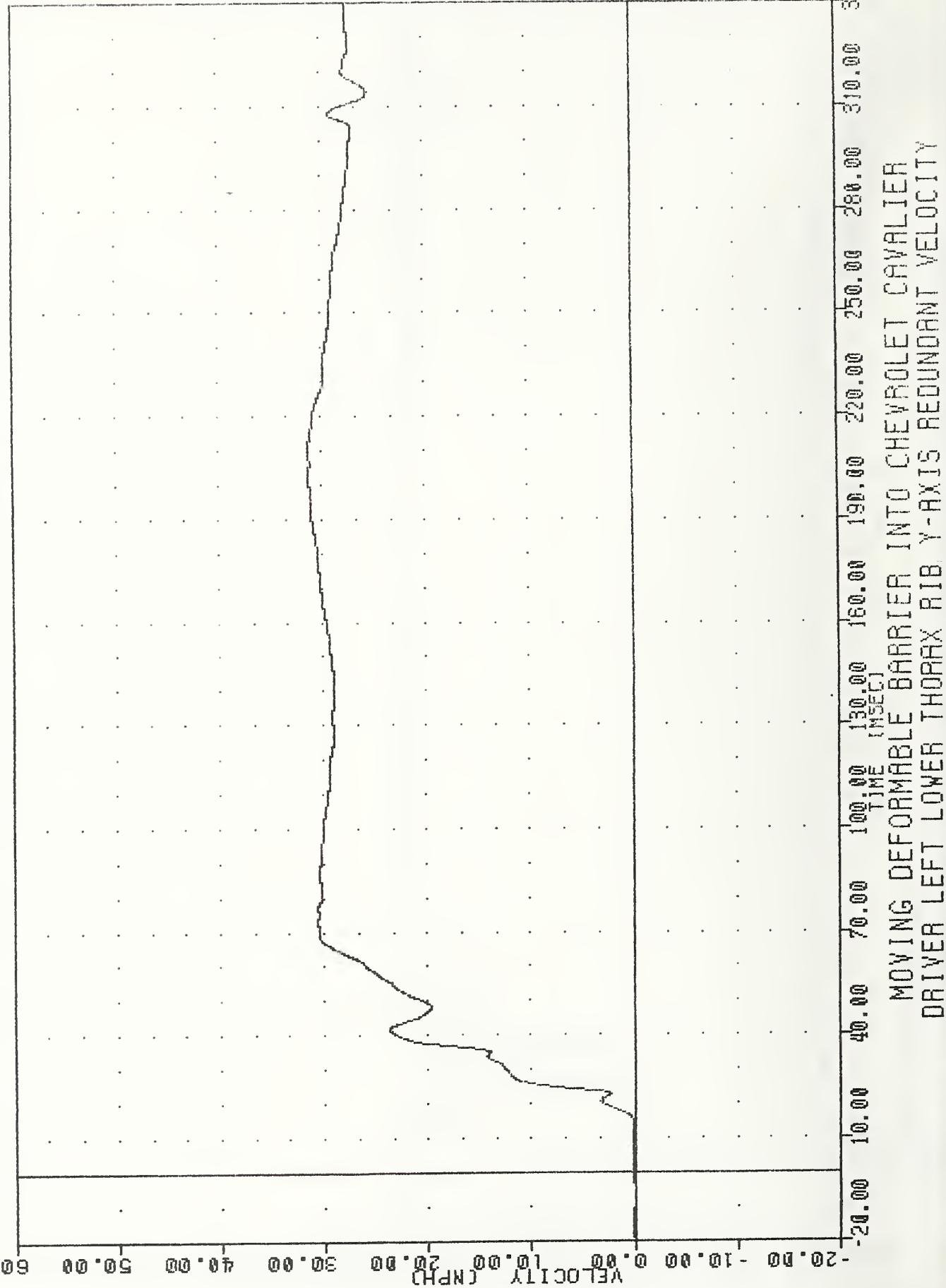
FILTER = HSRII 136/ 189/ -50
MIN, MAX VALUES = -45.598 310.00 , 100.00 & 23.75



MOWING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
DRIVER LEFT LOWER THORAX RIB Y-AXIS REDUNDANT ACCELERATION

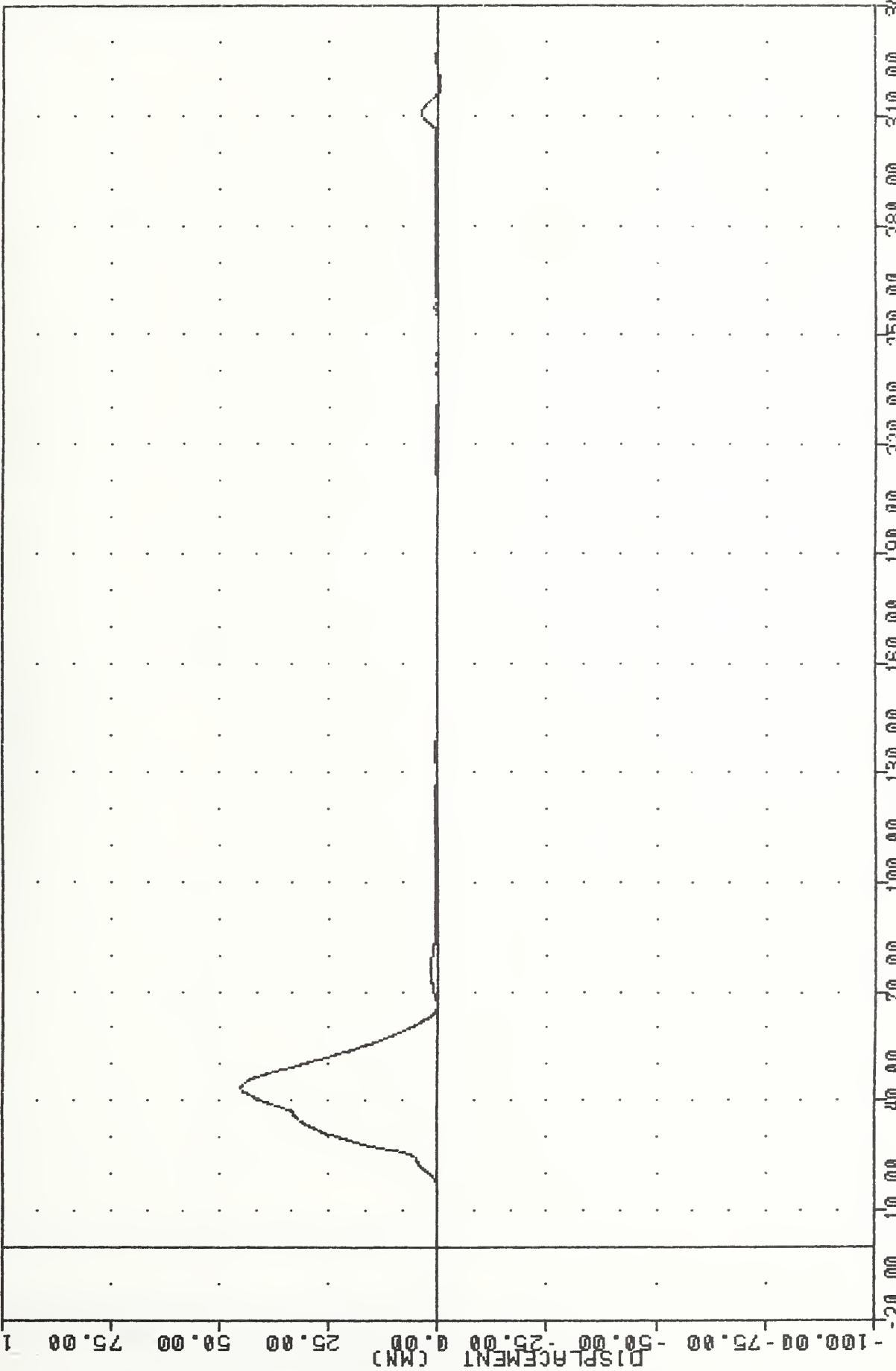
VRTC , 900604
SI PROTECTION PROD VEHICLE
90154 LLRYA

FILTER = BLPF 300/ 949/-40
MIN, MAX VALUES = -0.020 -7.80 , 31.26 & 210.25



VRTC 900604
SI PROTECTION PROD VEHICLE
90154
LLRY01

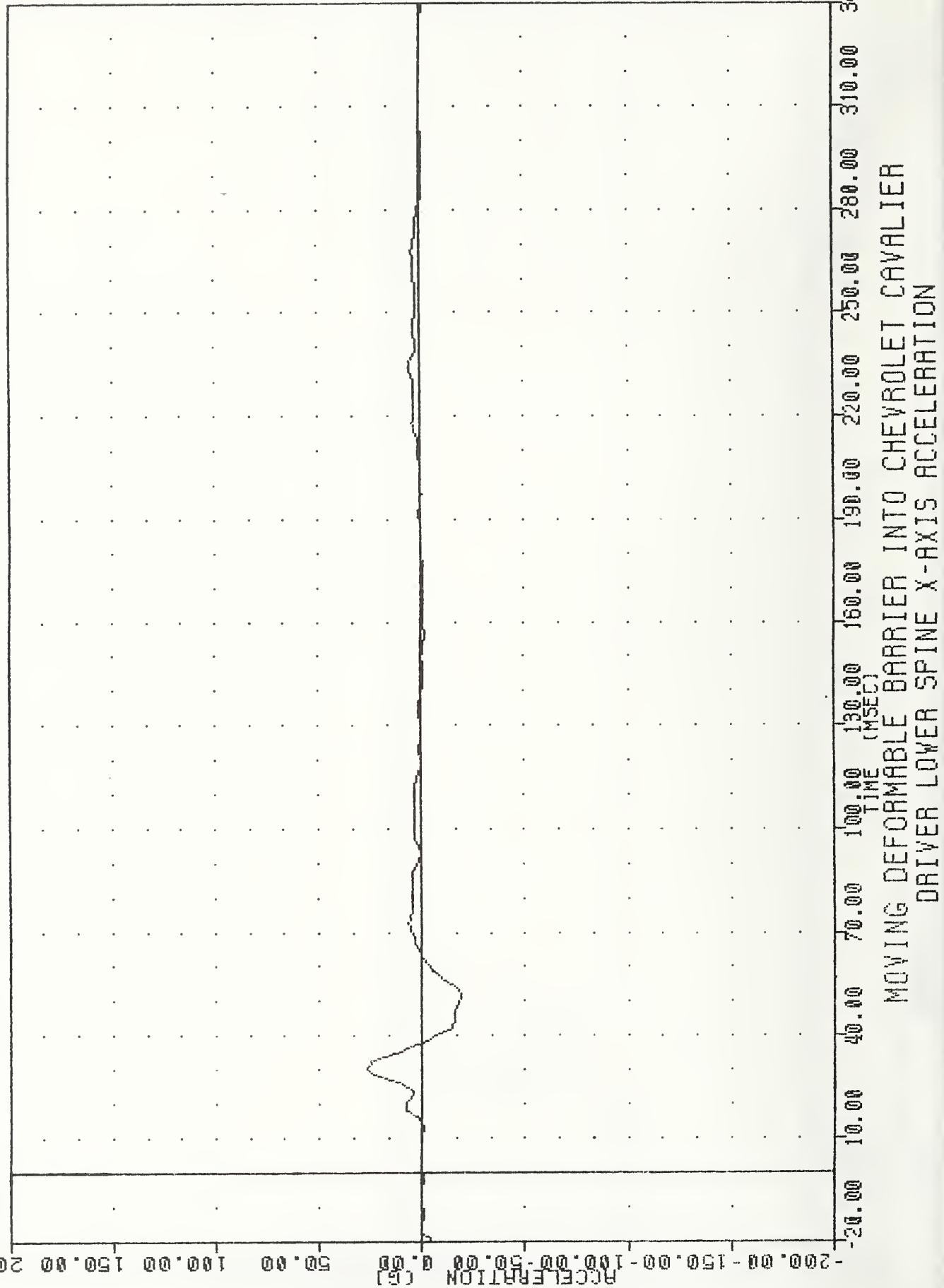
FILTER = BLPF 3000/ 949/-40
MIN. MAX VALUES = -0.668 318.00 , 45.04 & 43.50



TIME (MSEC)
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
DRIVER LEFT LOWER THORAX RIB DISPLACEMENT

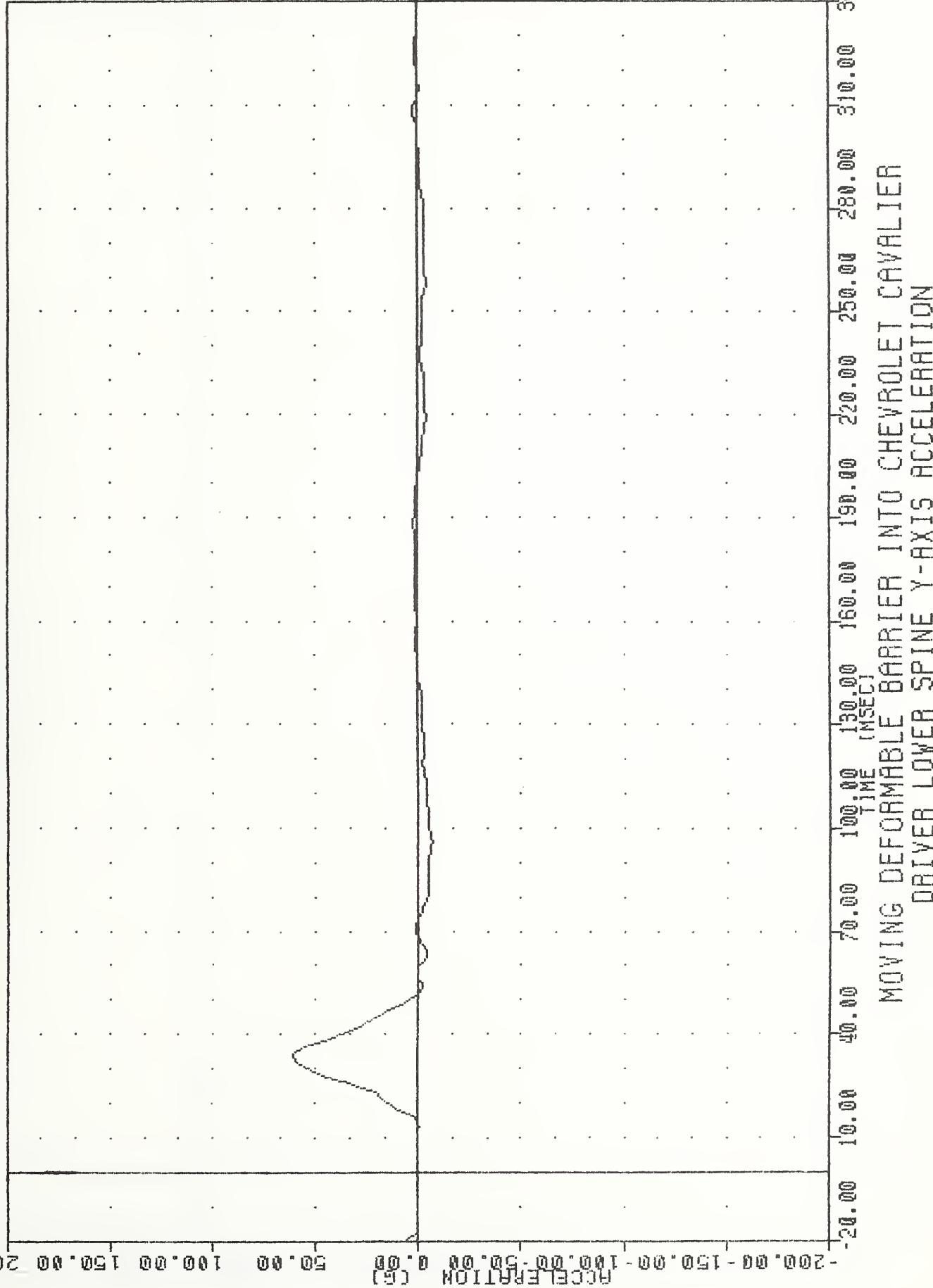
VRTC
SI PROTECTION PROD VEHICLE
9@154
T12X61

FILTER = HSRC 136/ 189/ -50
MIN, MAX VALUES = -19.028 51.25 , 26.74 e 30.62



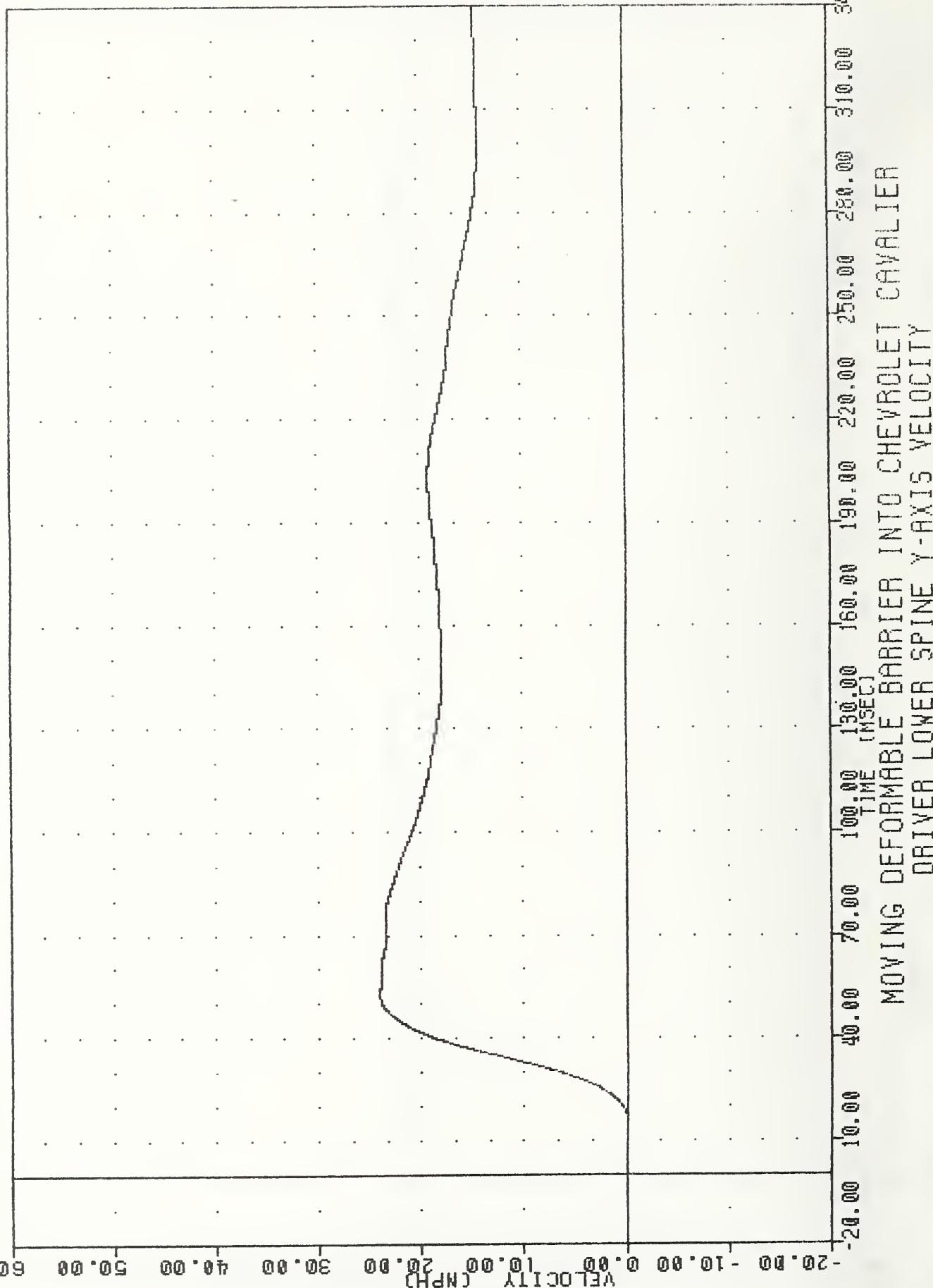
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
112Y61

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -6.688 96.25 , 60.91 @ 33.75



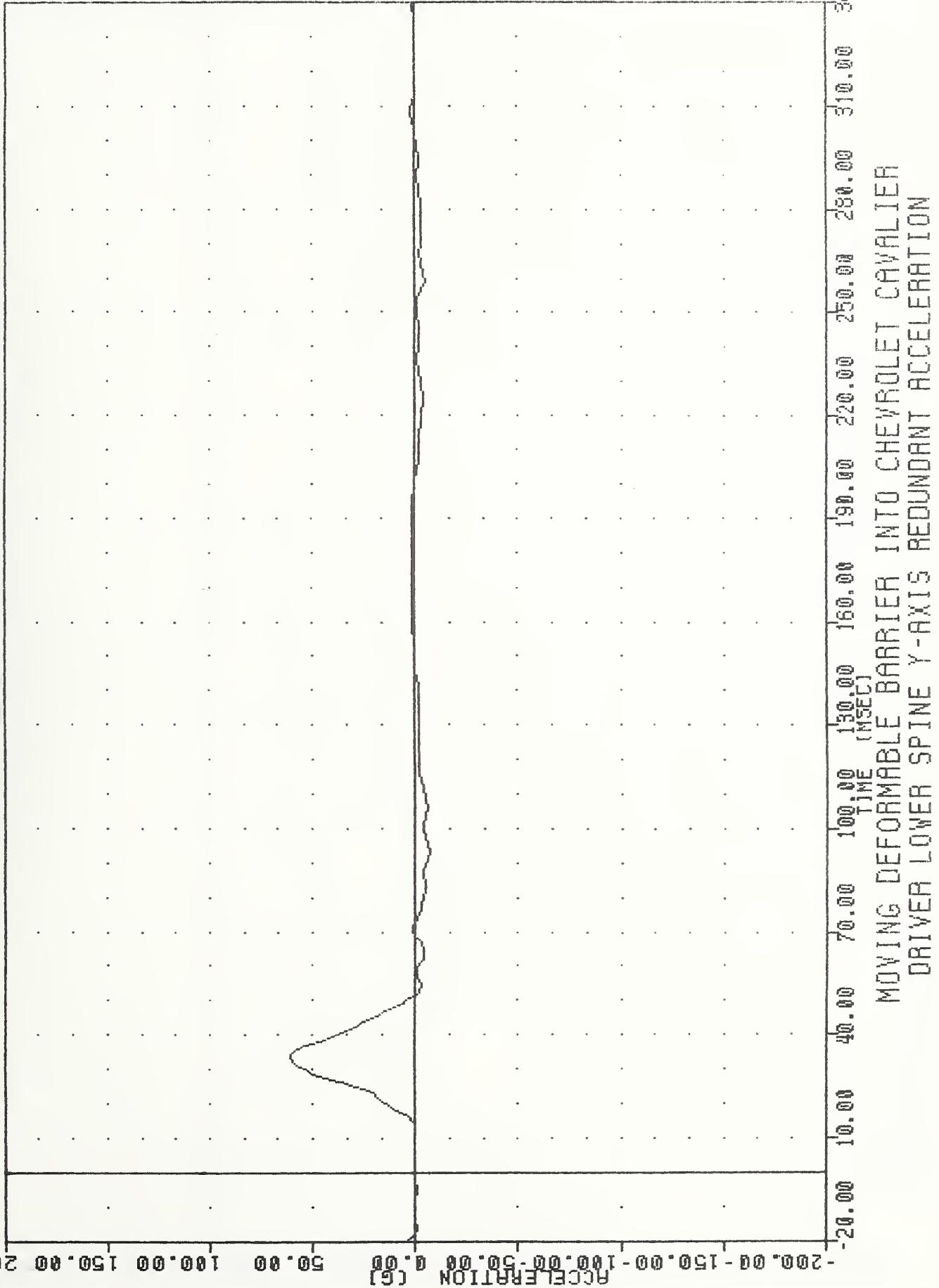
VRTC 900604
SI PROTECTION PAID VEHICLE
90154
T12YV1

FILTER = BLPF 3000/ 949/-40
MIN, MAX VALUES = -0.0088 13.25 , 24.02 & 52.89



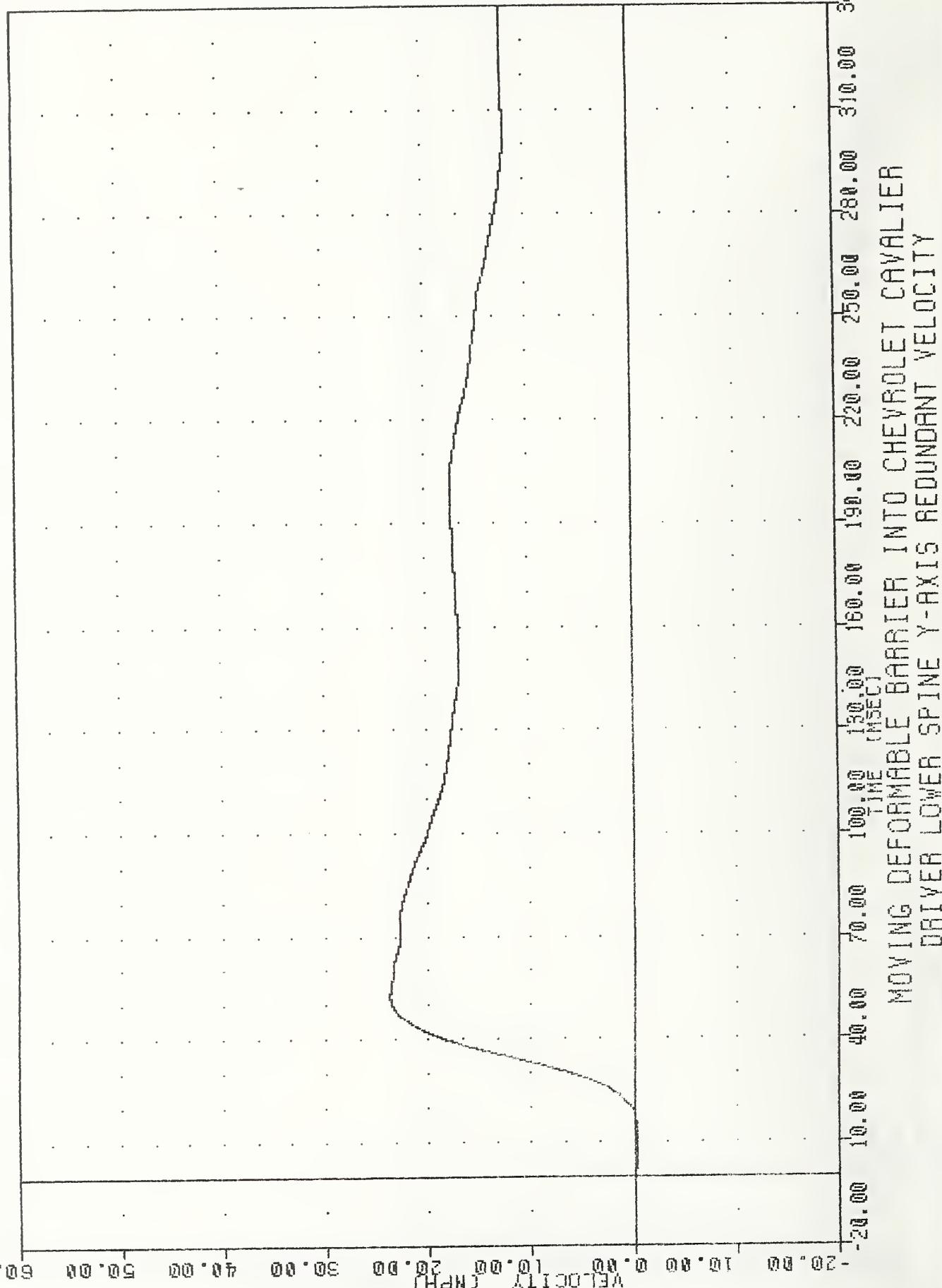
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
112Y6A

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -6.888 93.75 , 61.09 & 33.75



YRTC, 900004
SI PROTECTION PROD VEHICLE
90154
112YVA

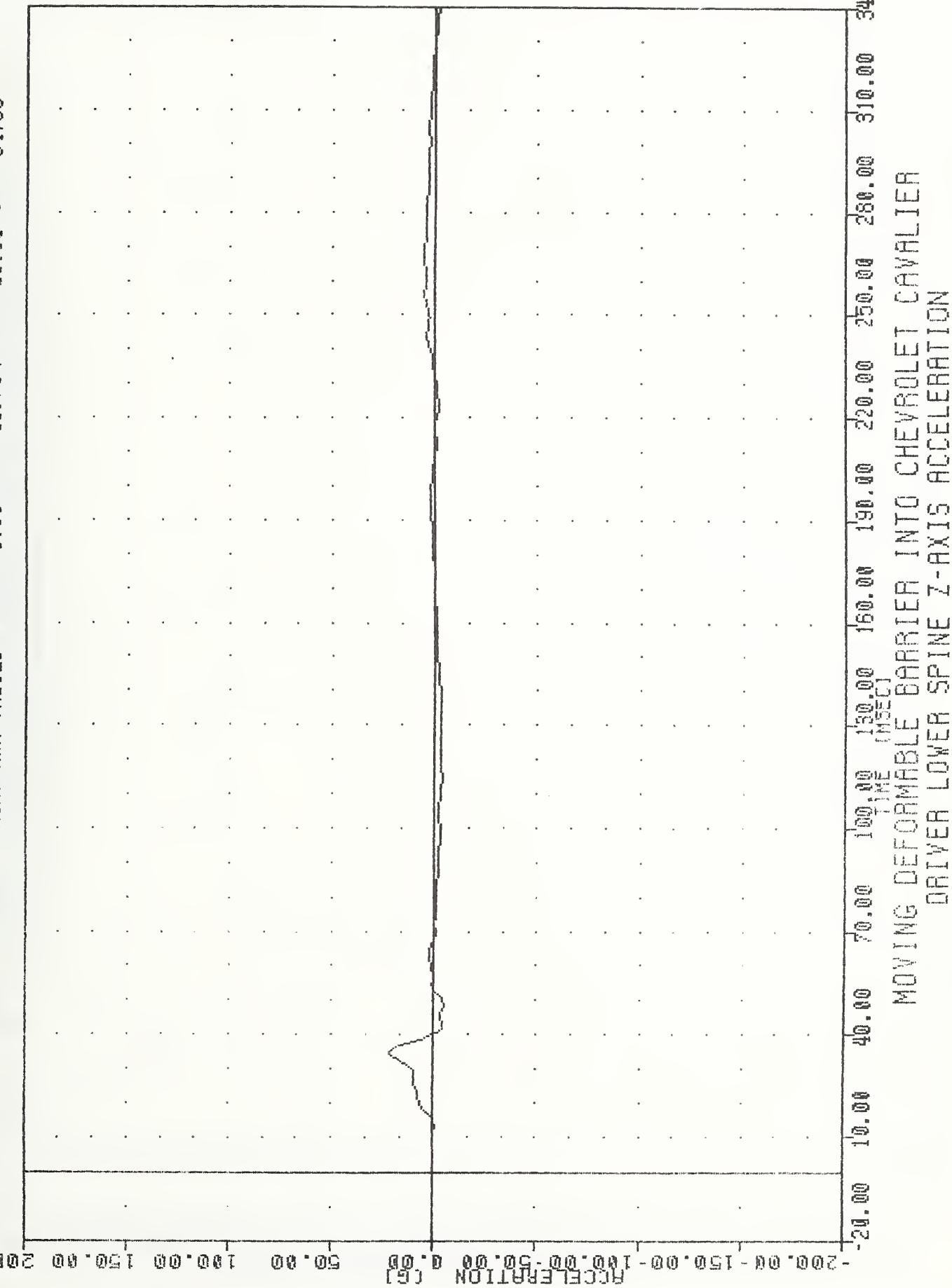
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.268 9.68 , 23.78 & 52.50



YRTC "900604
SI PROTECTION PHOD VEHICLE
90154
112761

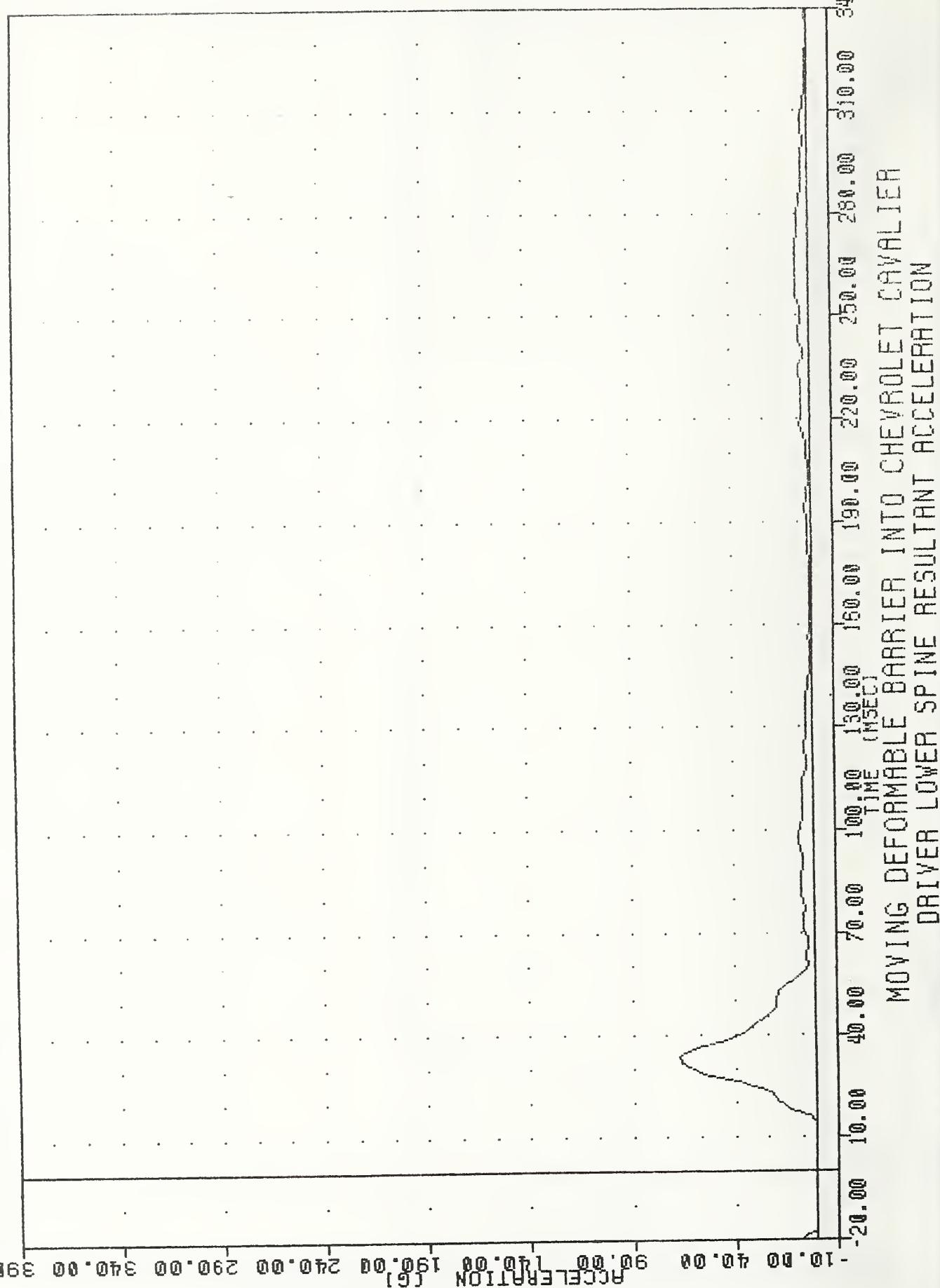
MIN. MAX VALUES = -5.058 48.75 , 21.35 e 34.38

FILTER = HSRI 136/ 189/ -50



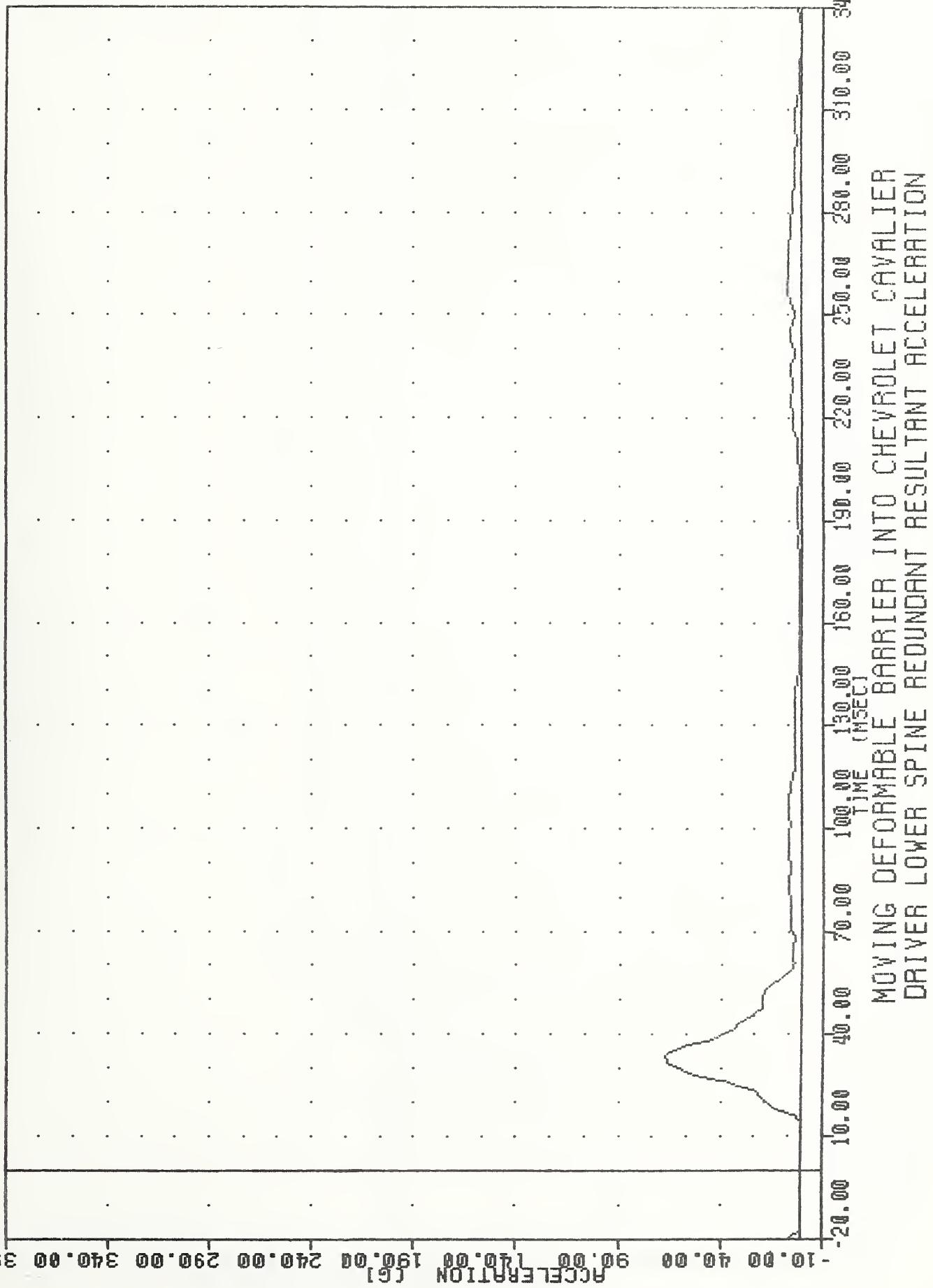
VRTC , 900604
SI PROTECTION PROD VEHICLE
9@154 112RG1

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.028 6.25 , 56.97 & 33.13



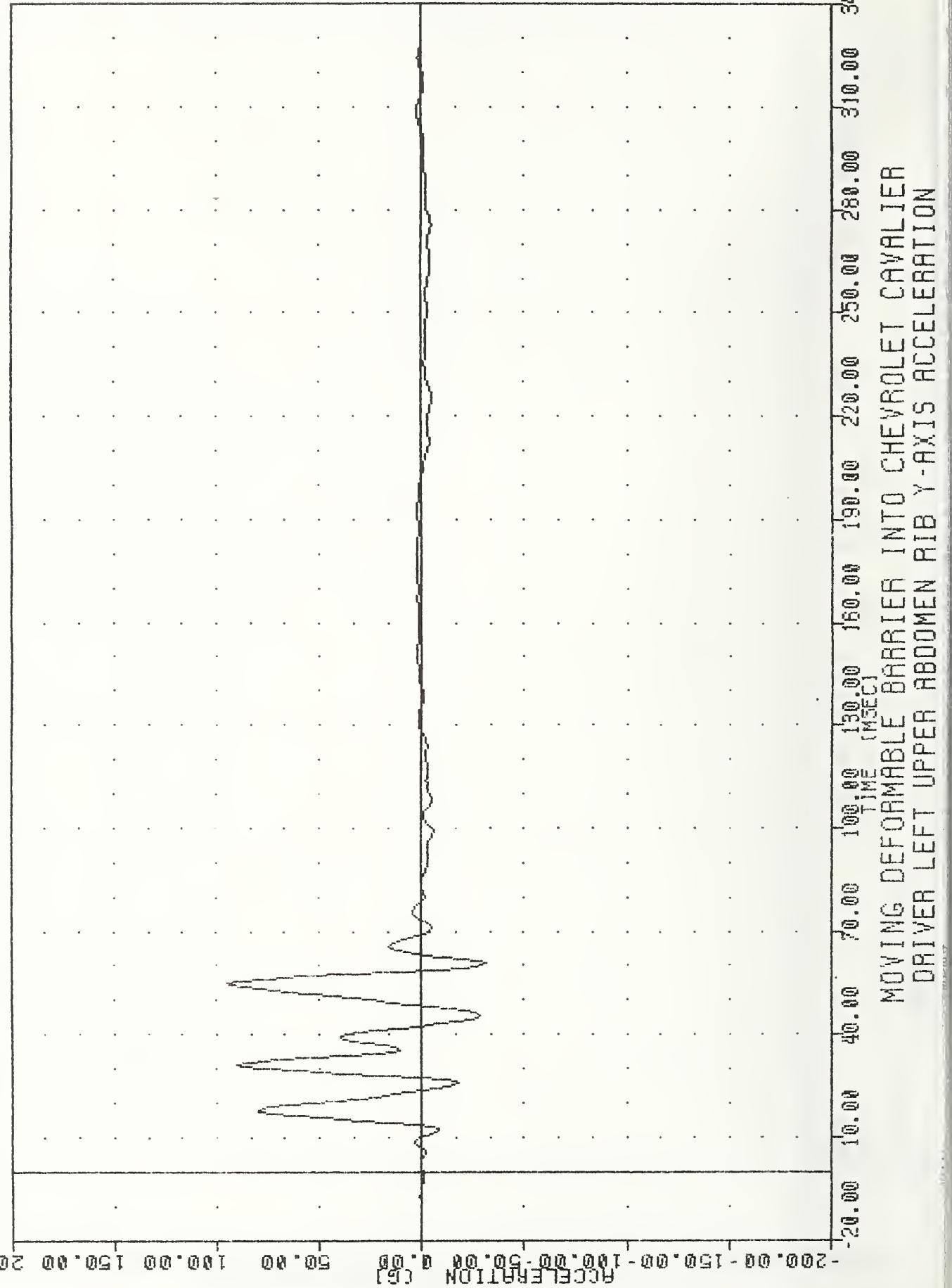
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
T12RGA

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.098 1.68 , 67.06 @ 33.13



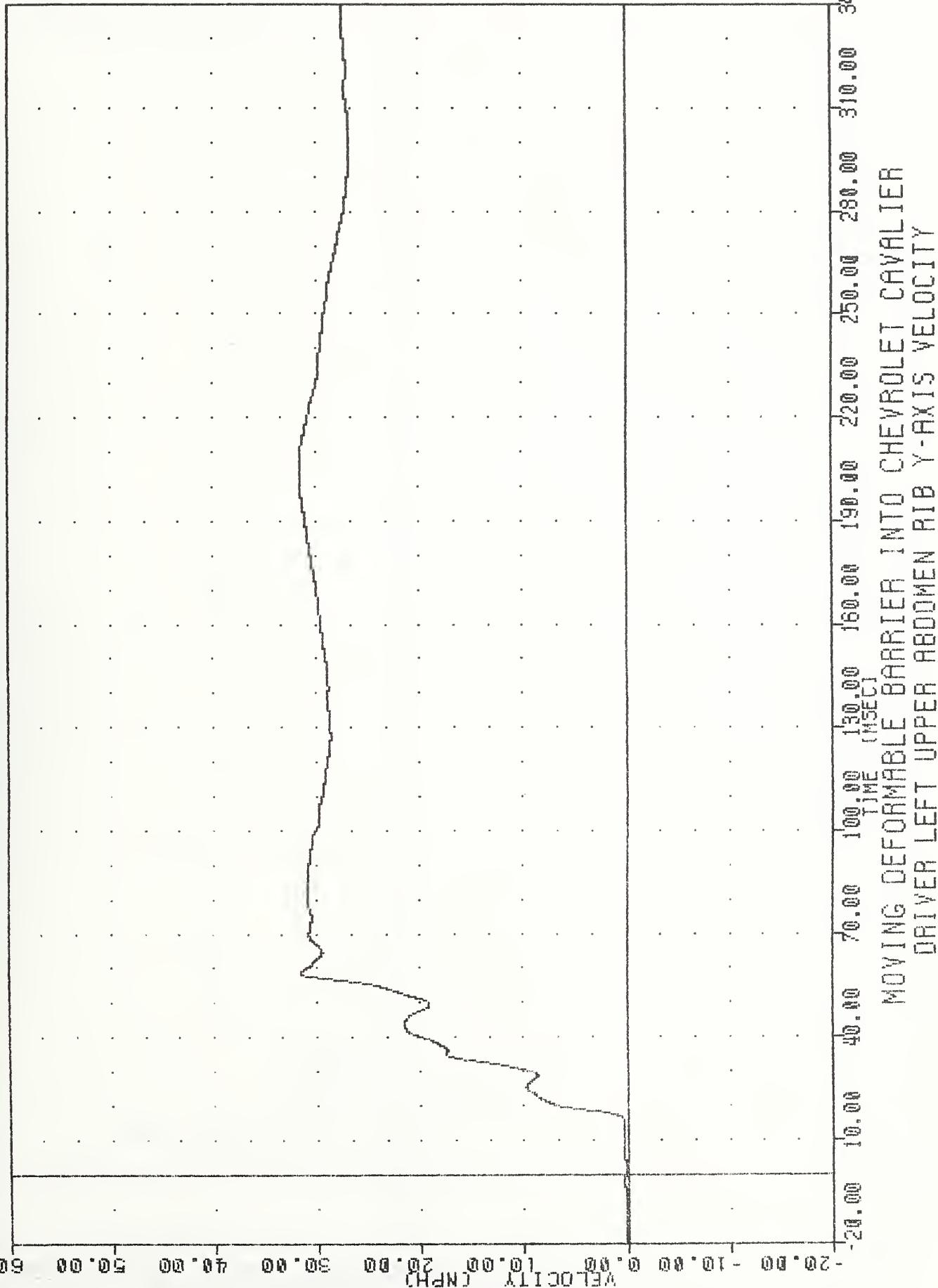
VFITC
SI PROTECTION PROD VEHICLE
90154
LURY61

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -31.25 e 60.62 , 94.46 e 55.00

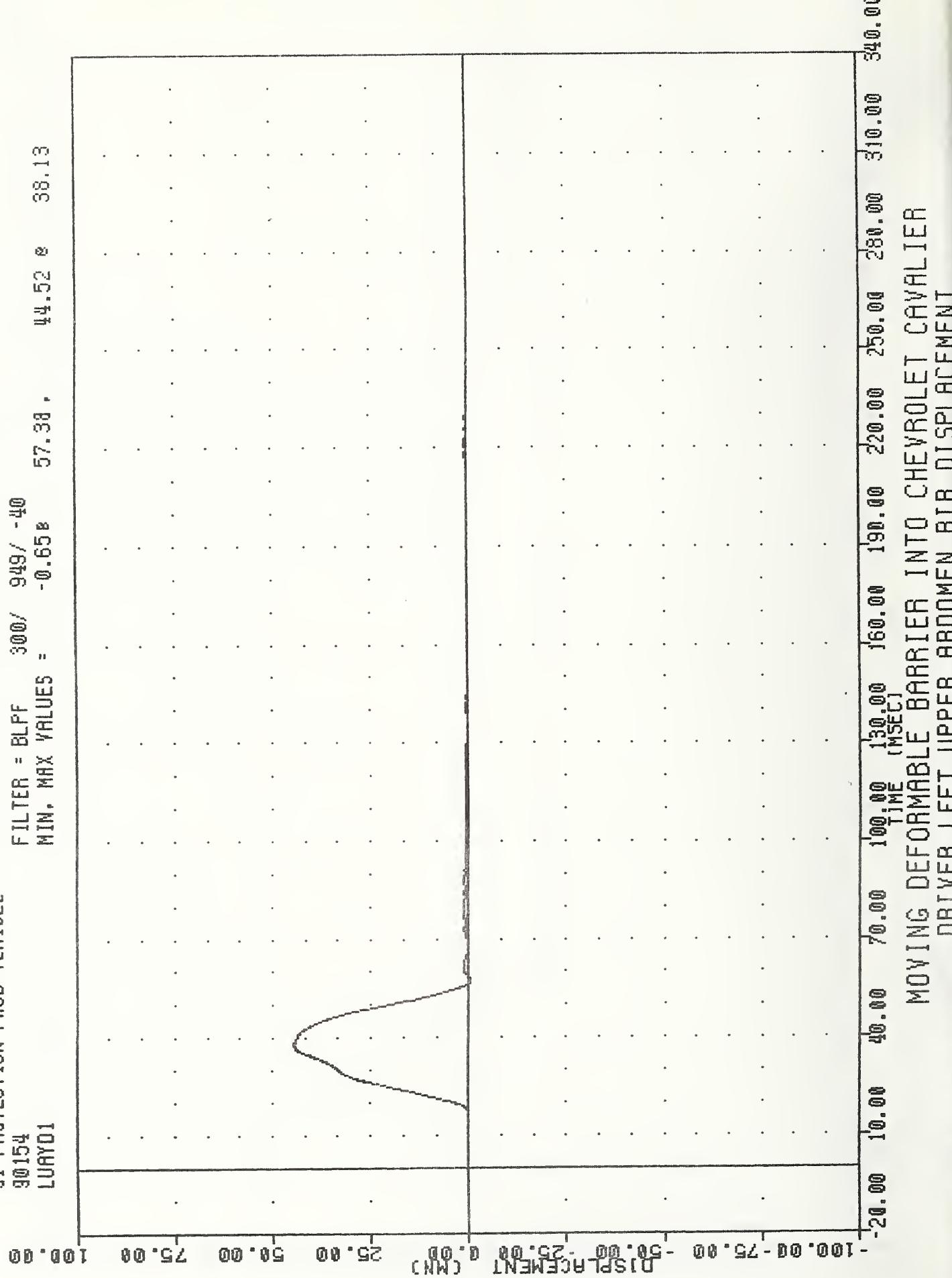


YRTC
SI PROTECTION FROM VEHICLE
90154
LURVY1

90@604
FILTER = BLPP
MIN, MAX VALUES = 0.000 - 20.00
31.60 @ 58.63

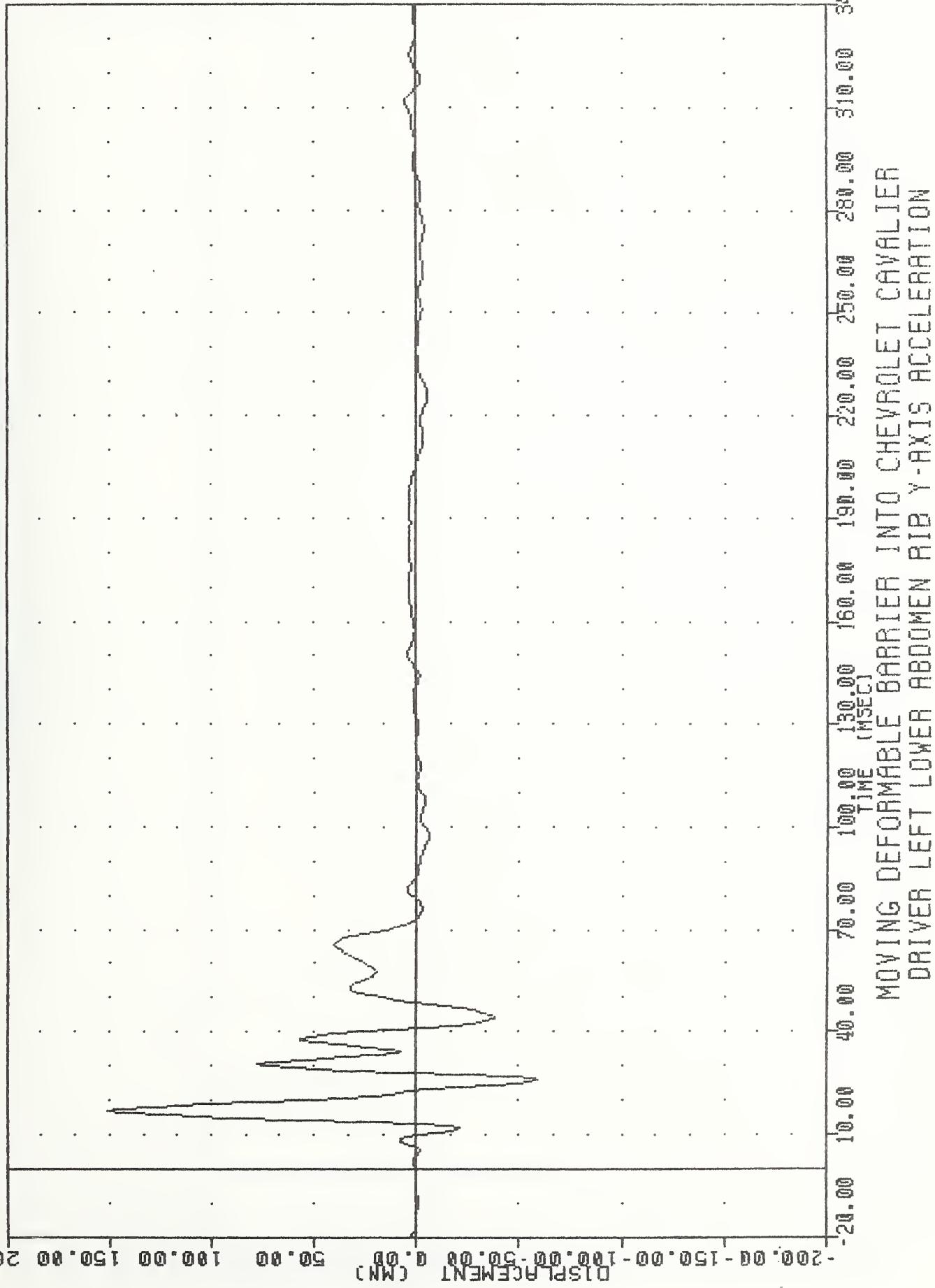


VRTC
SI PROTECTION PROD VEHICLE
90154
LURY01



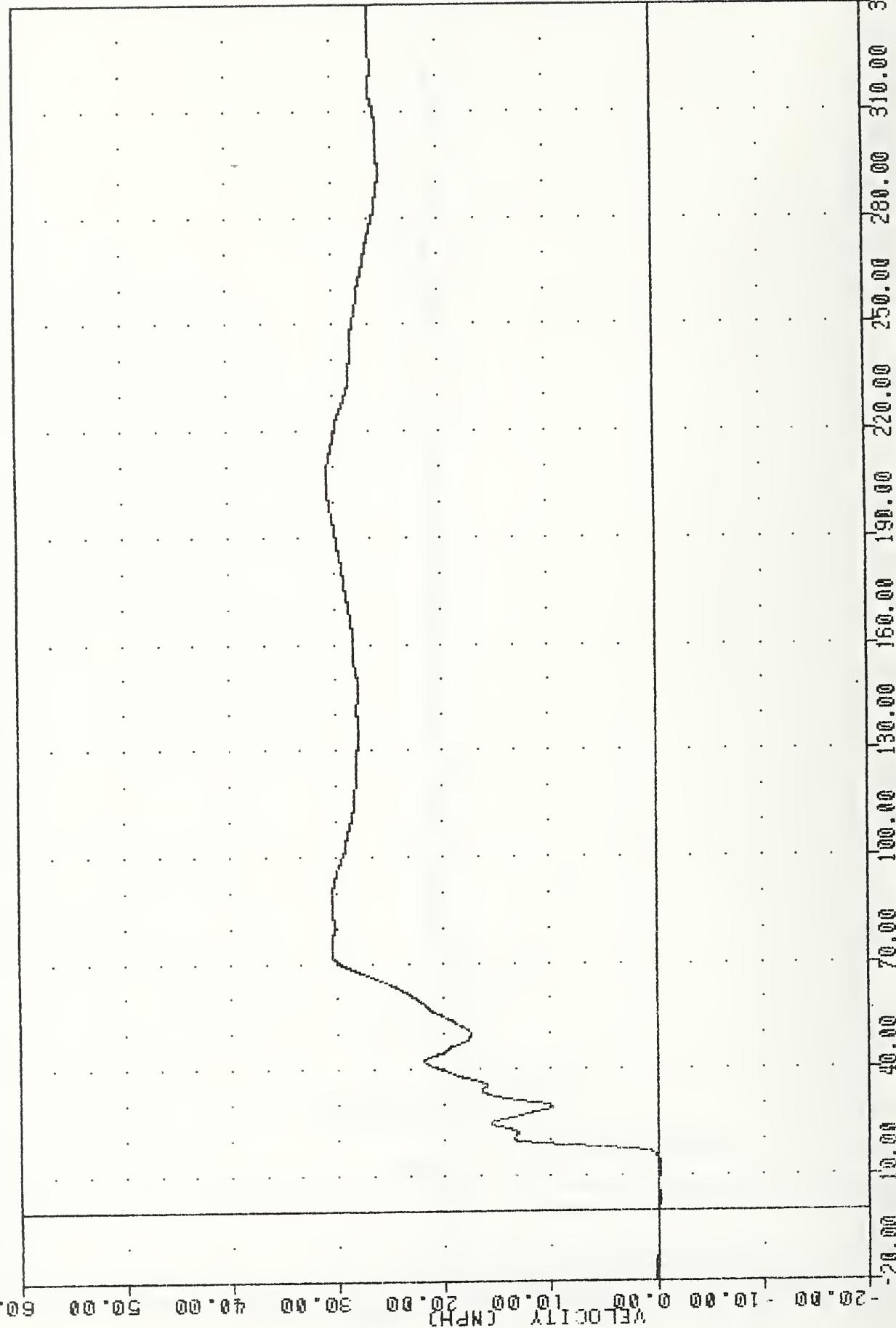
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
LLAY61

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -59.04 e 25.63 . 151.28 e 16.87



YRTC 900604
SI PROTECTION PROD VEHICLE
90154
LLAY1

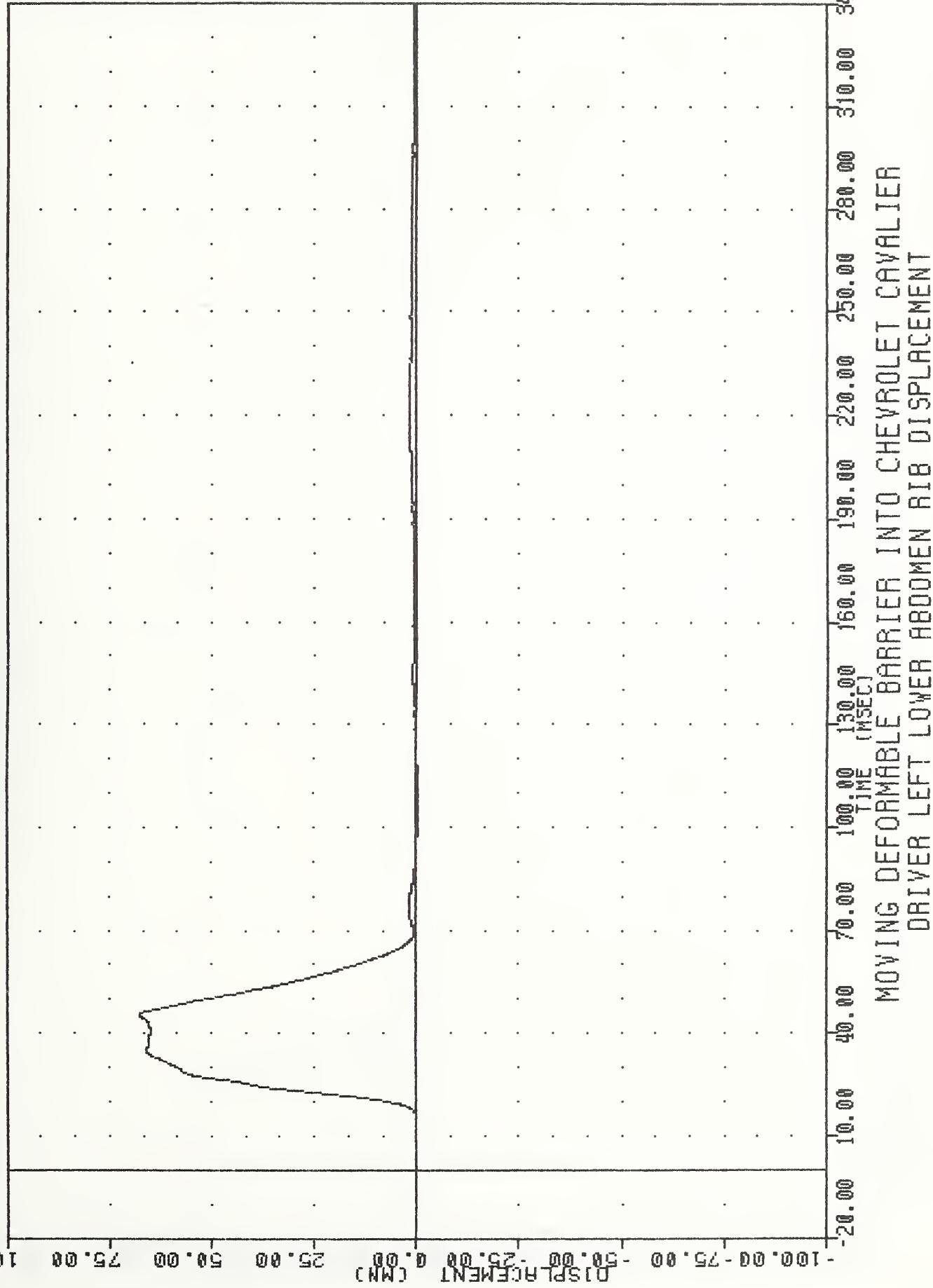
FILTER = BLPP 300/ 949/-40
MIN. MAX VALUES = -0.278 11.38 , 30.71 @ 205.13



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
DRIVER LEFT LOWER ABDOMEN RIB Y-AXIS VELOCITY

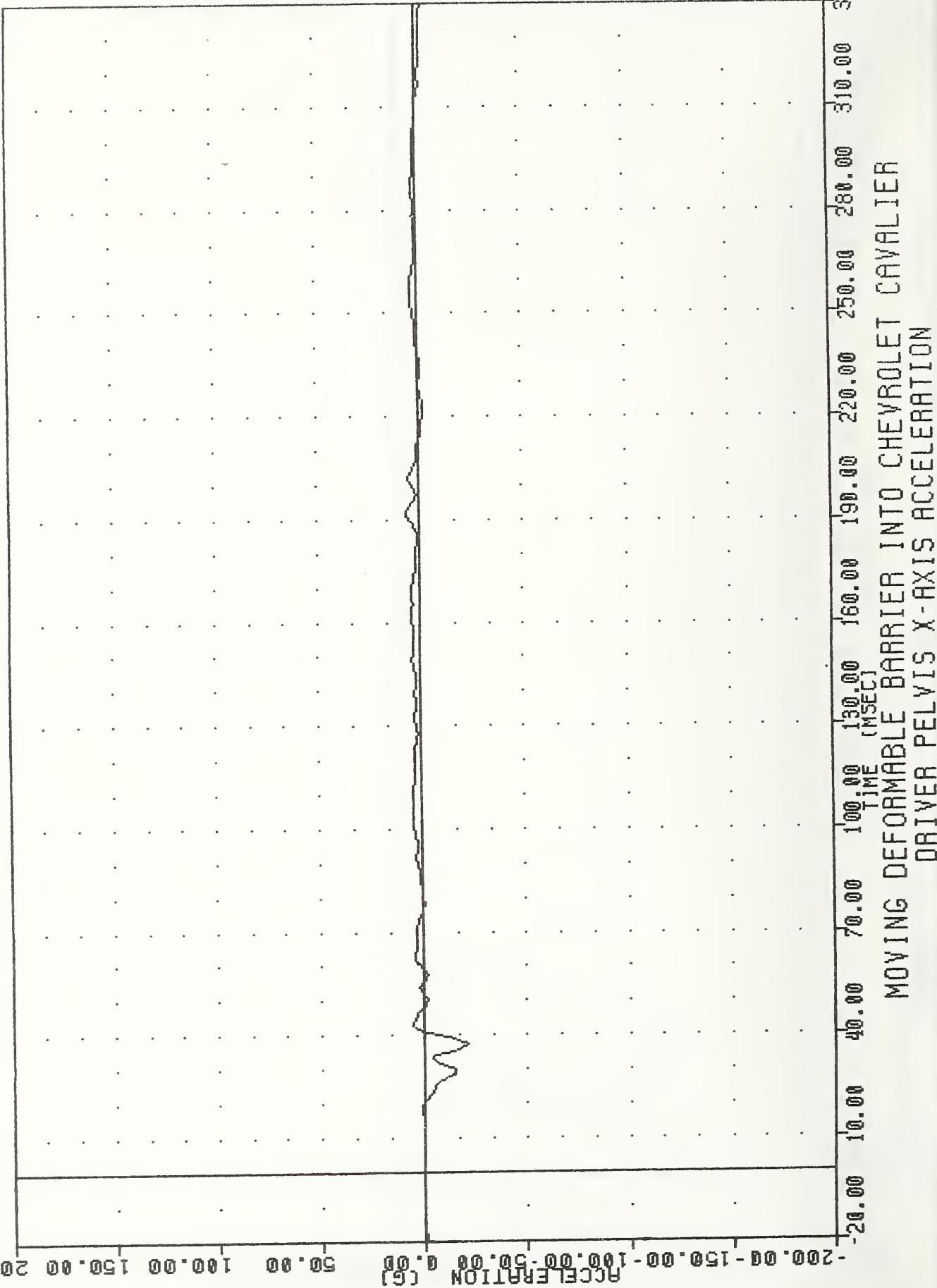
VRTC
SI PROTECTION PROD VEHICLE
90154
LLAYD1

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.378 104.50 , 67.61 & 45.50



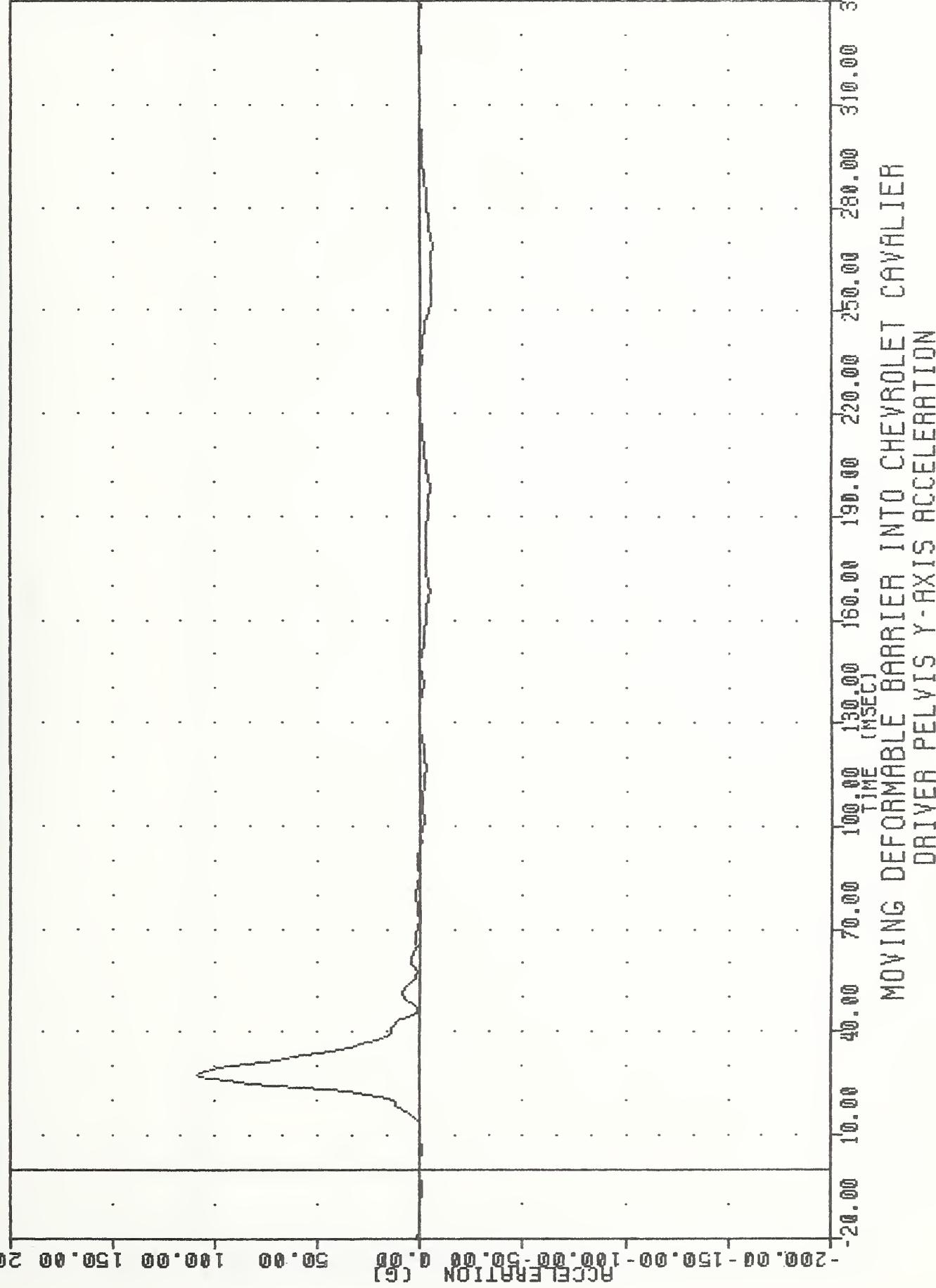
VRTC , 900604
SI PROTECTION PROD VEHICLE
9@154
PEVXG1

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -20.538 37.50 , 6.26 & 191.88



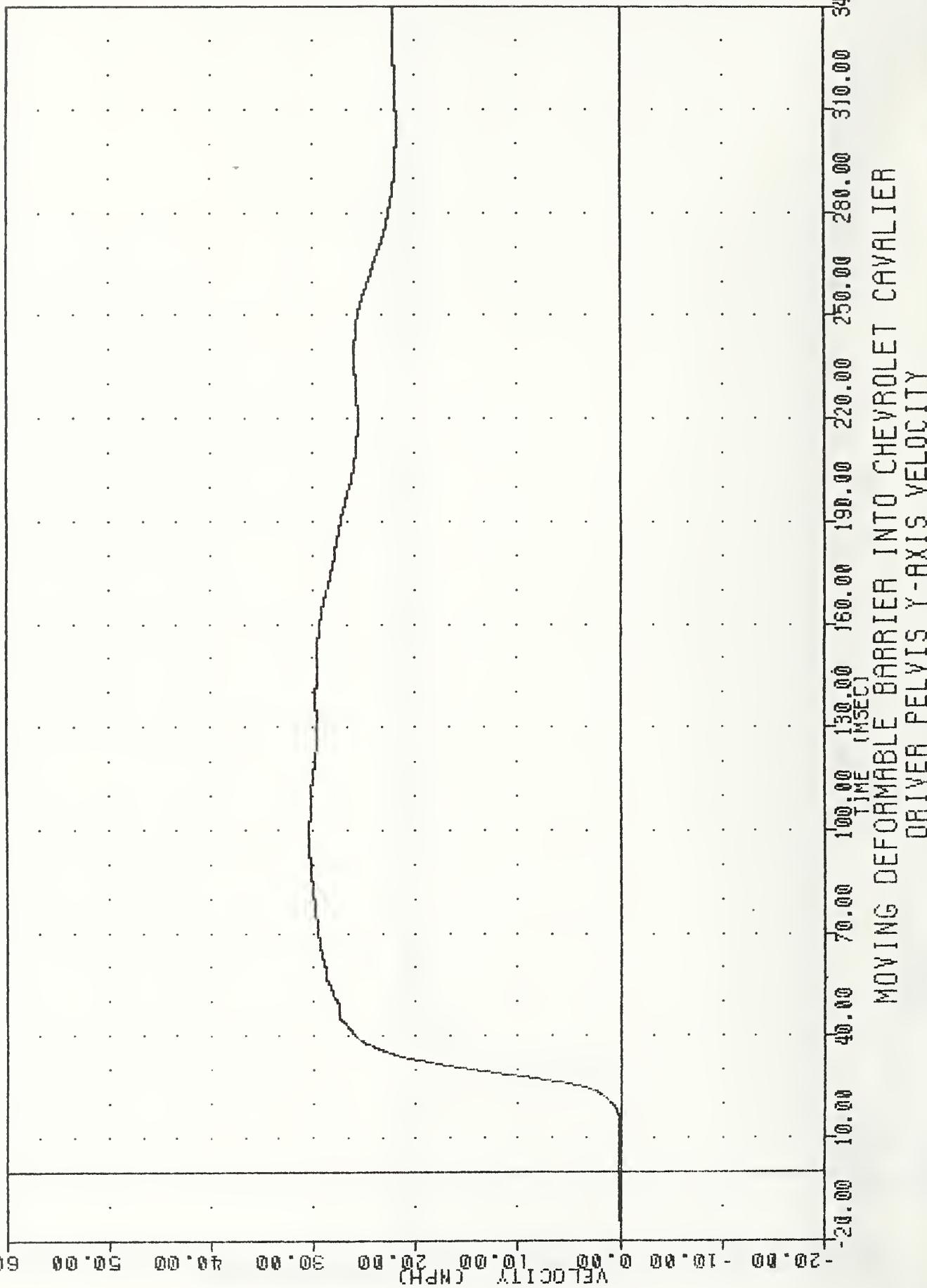
VRTC
SI PROTECTION PAD VEHICLE
90154
PEV161

FILTER = HSRL 136/ 189/ -50
MIN. MAX VALUES = -5.75@ 268.75 , 108.73 @ 27.50



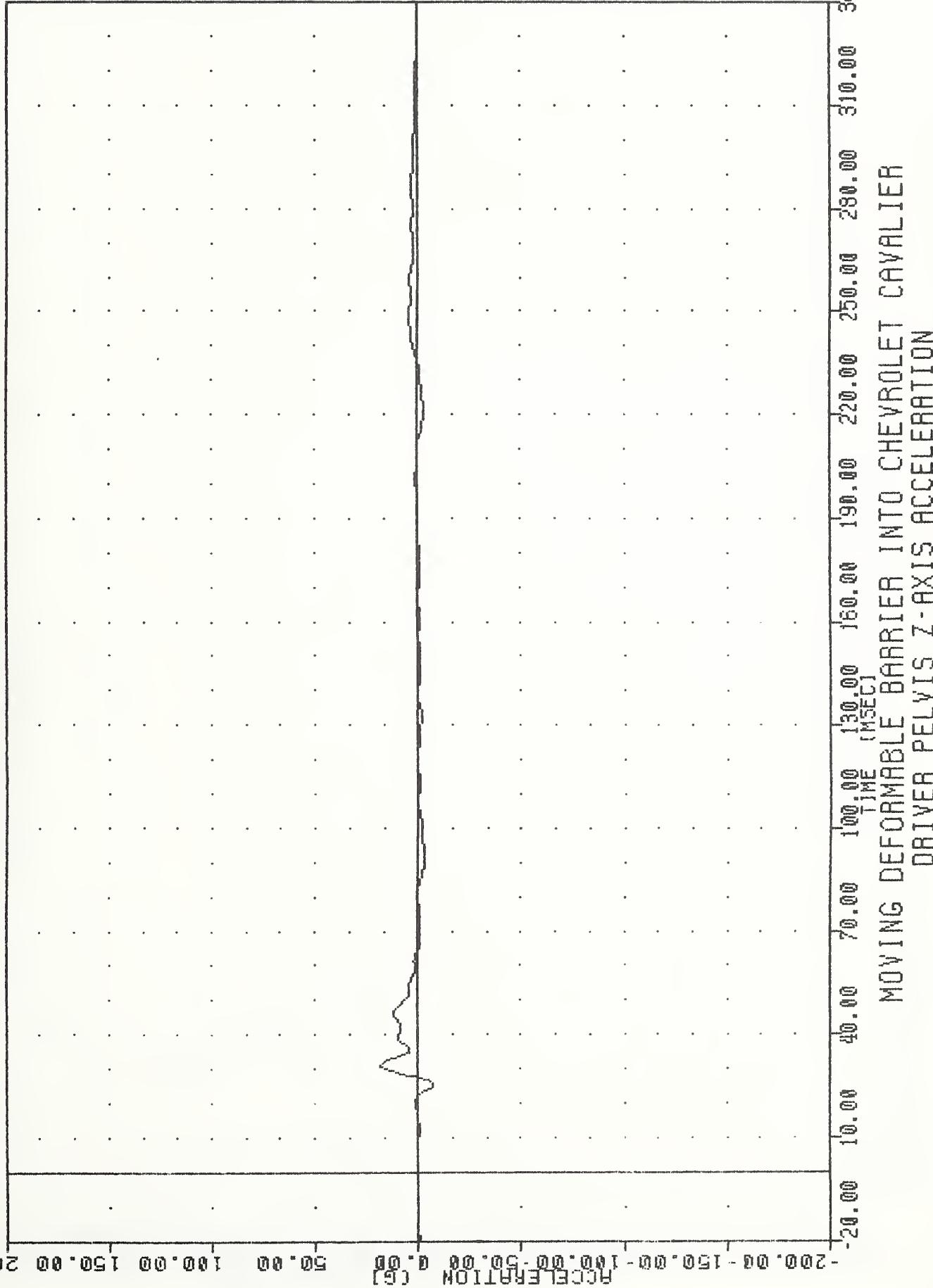
YRTC , 9W0604
SI PROTECTION PROD VEHICLE
90154
PEYYV1

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = 0.00 e -16.75 , 30.39 e 97.63



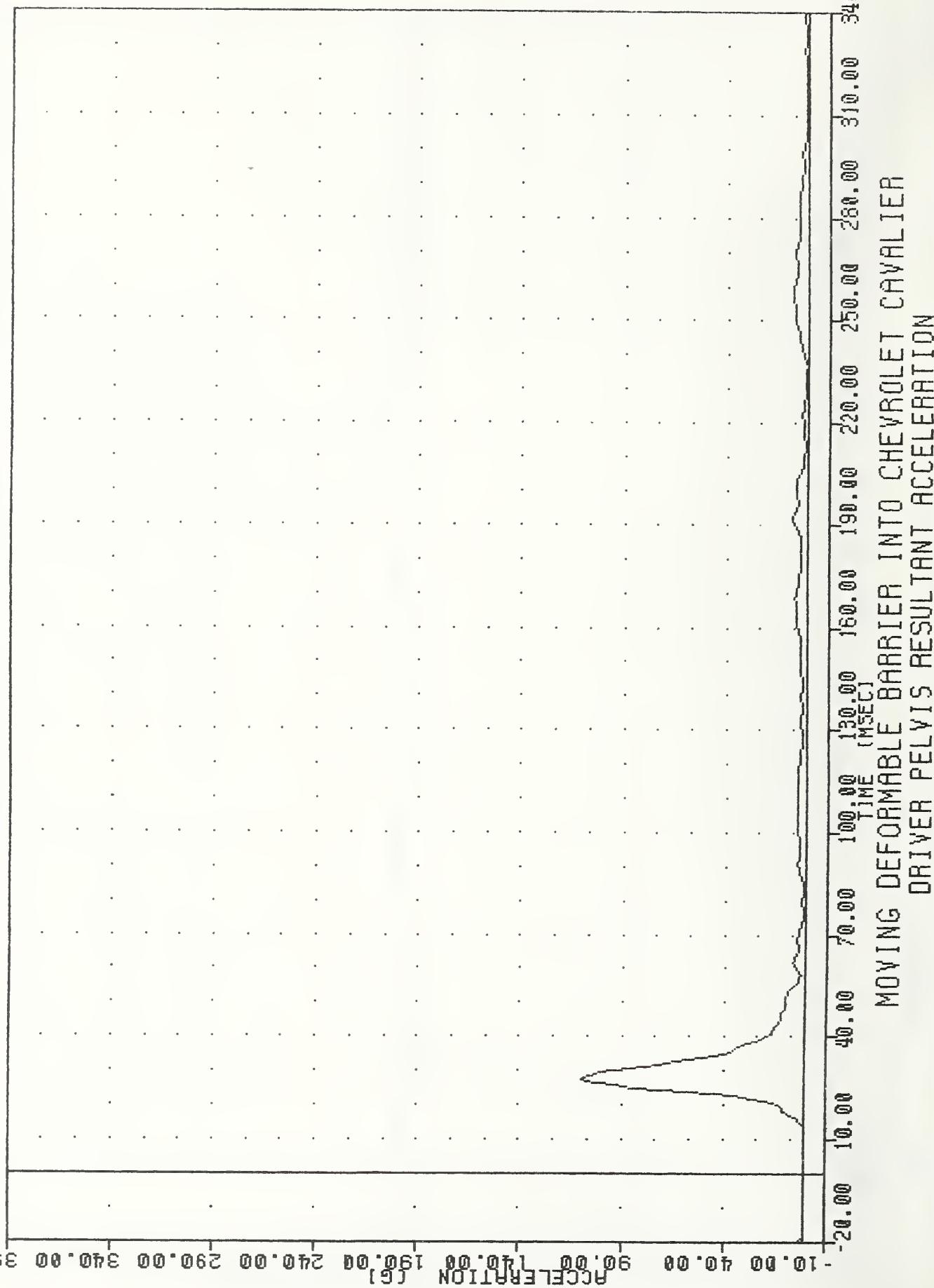
VRTC 900004
SI PROTECTION PROD VEHICLE
90154
PEVZ1

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -7.358 25.63 , 18.30 & 31.25

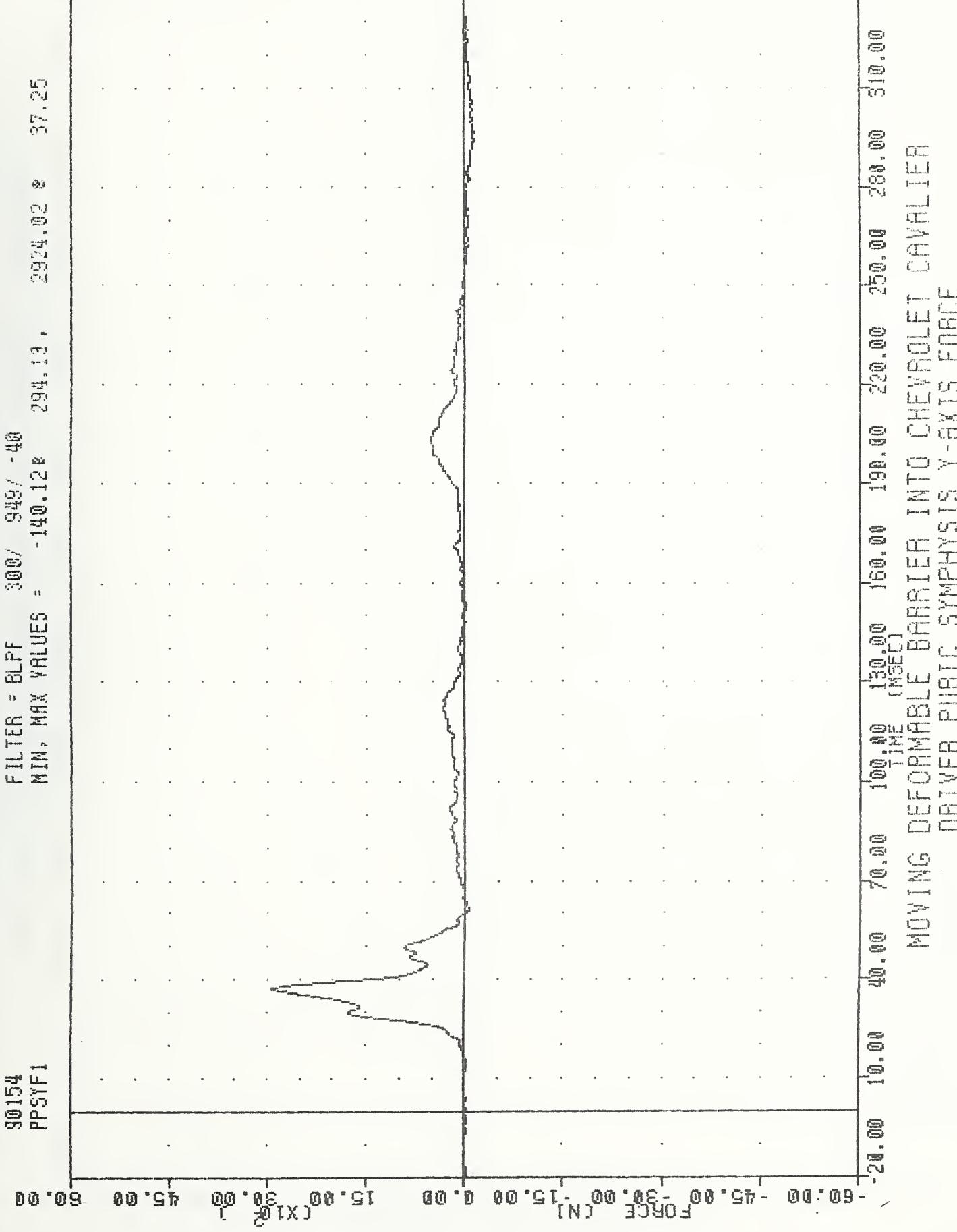


VRTC
SI PROTECTION PROD VEHICLE
90154
PEVRG1

900604
FILTER = HSRI 136/
MIN, MAX VALUES = 0.088 8.75 109.27 27.50

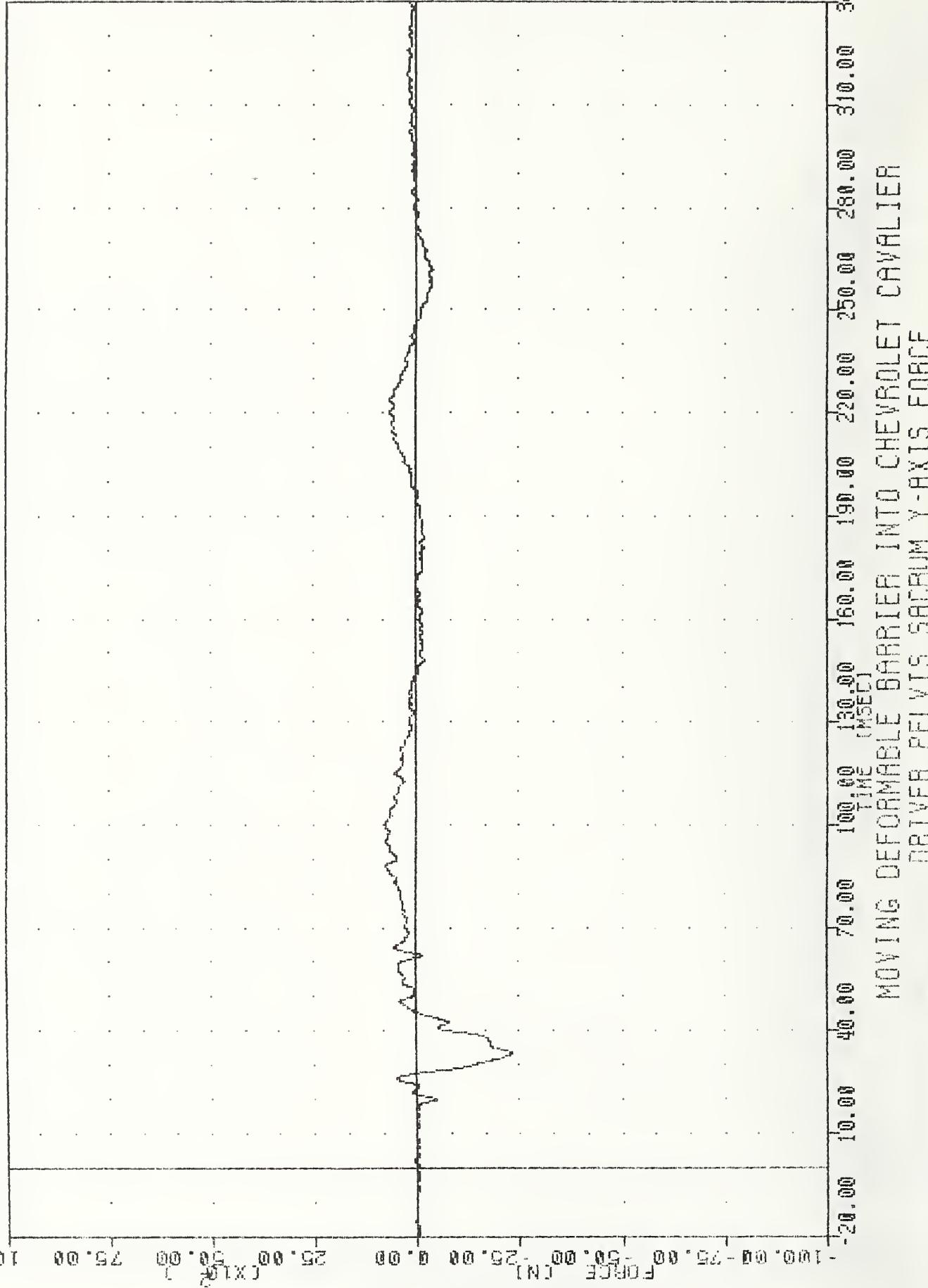


VEHIC
S1 PROTECTION , PROD VEHICLE



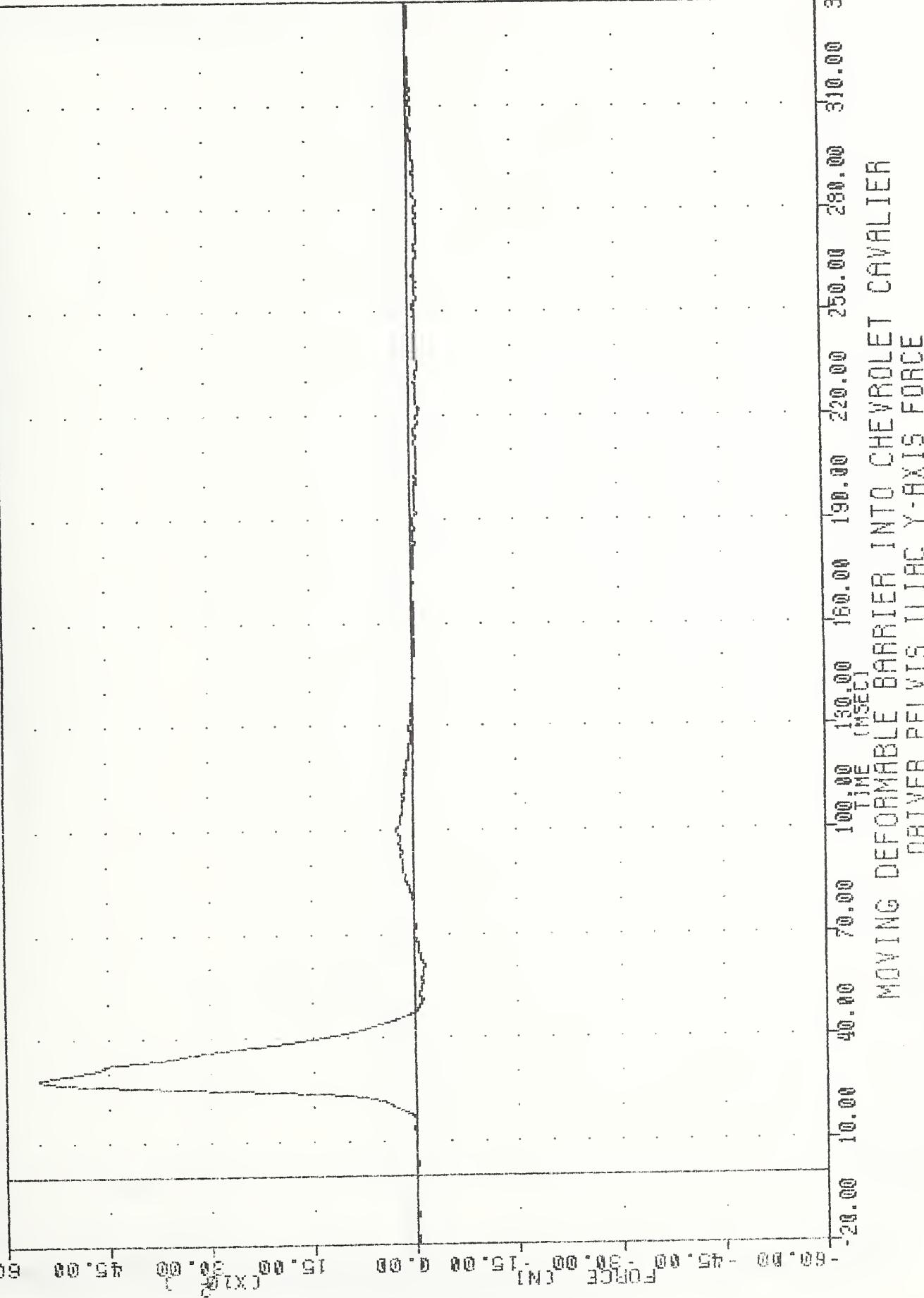
YRTC
SI PROTECTION FREE VEHICLE
30154
PSH/F1

FILTER = BLPF 3000/ 343/-40
MIN. MAX VALUES = -2317.368 33.56 , 761.93 & 99.63



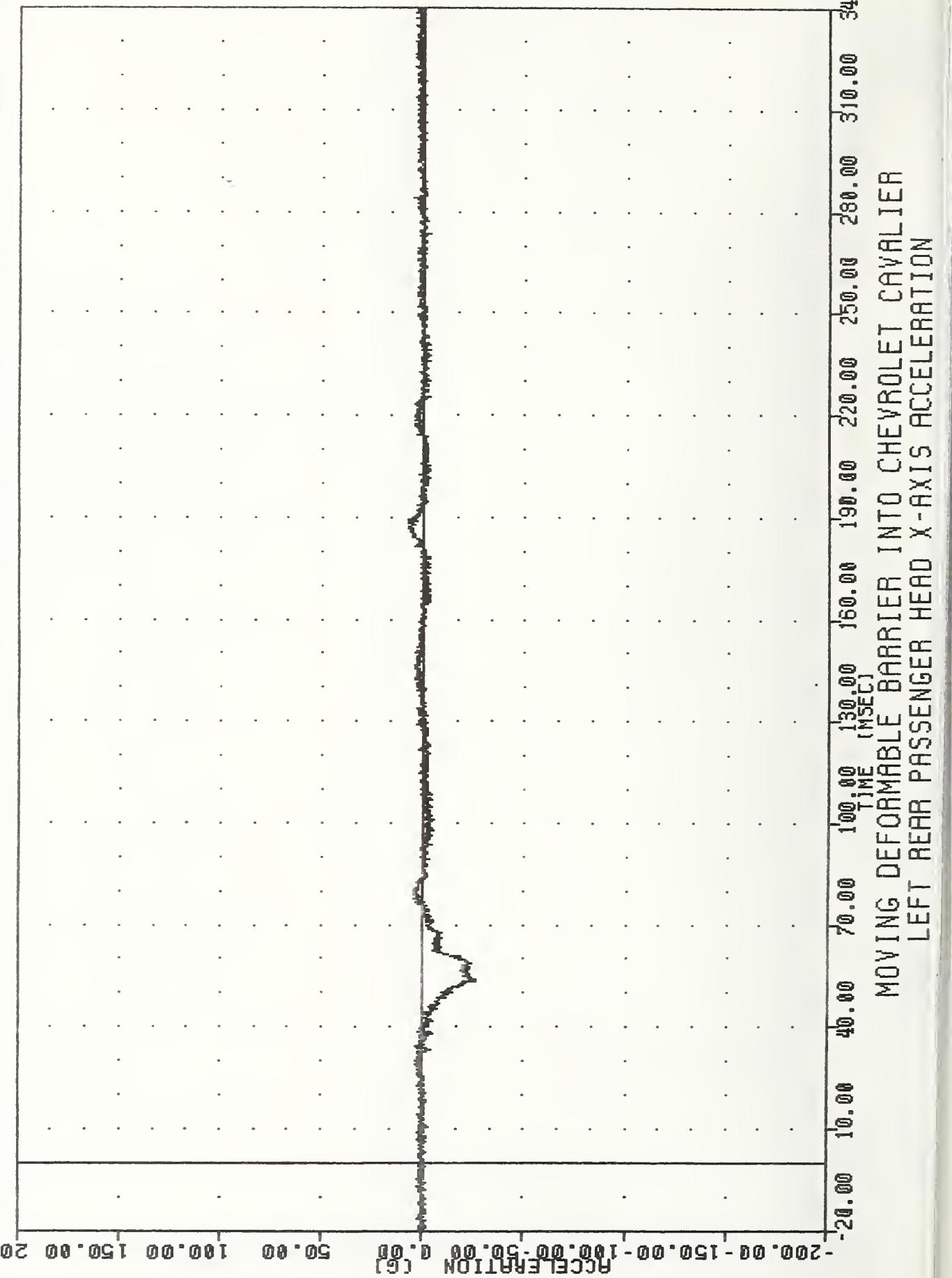
VERTIC
SI PROTECTION PROD VEHICLE
30.454
PLATE1
0.00 60.00 120.00 180.00 240.00 300.00 360.00

MIN, MAX VALUES = -141.158 60.75 - 5509.81 0 28.13
FILTER = BLPF 3000/ 949/ -40



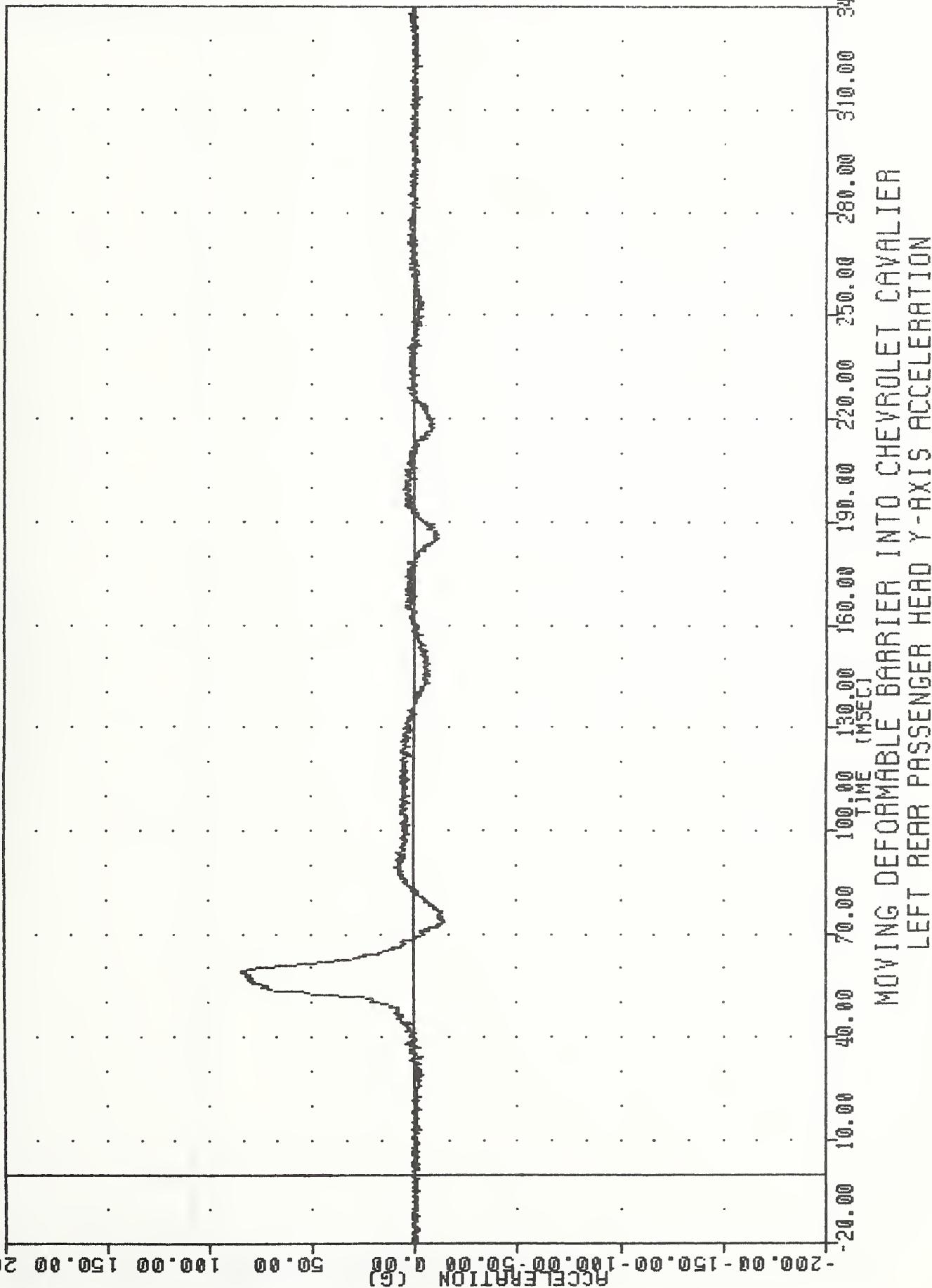
VRTC
SI PROTECTION PROD VEHICLE
90154
HDXG4

FILTER = FILPF 1650/ 5214/ -40
MIN. MAX VALUES = -26.608 53.75 , 8.10 8 169.13



VRTC 900604
SI PROTECTION PROD VEHICLE
90154
HEADGY4

FILTER = BLPF 1650/ 5214/ -40
MIN. MAX VALUES = -14.80 e 73.63 . B4.16 e 58.75



VRTC , 900604
SI PROTECTION PROD VEHICLE
90154 HEDY44

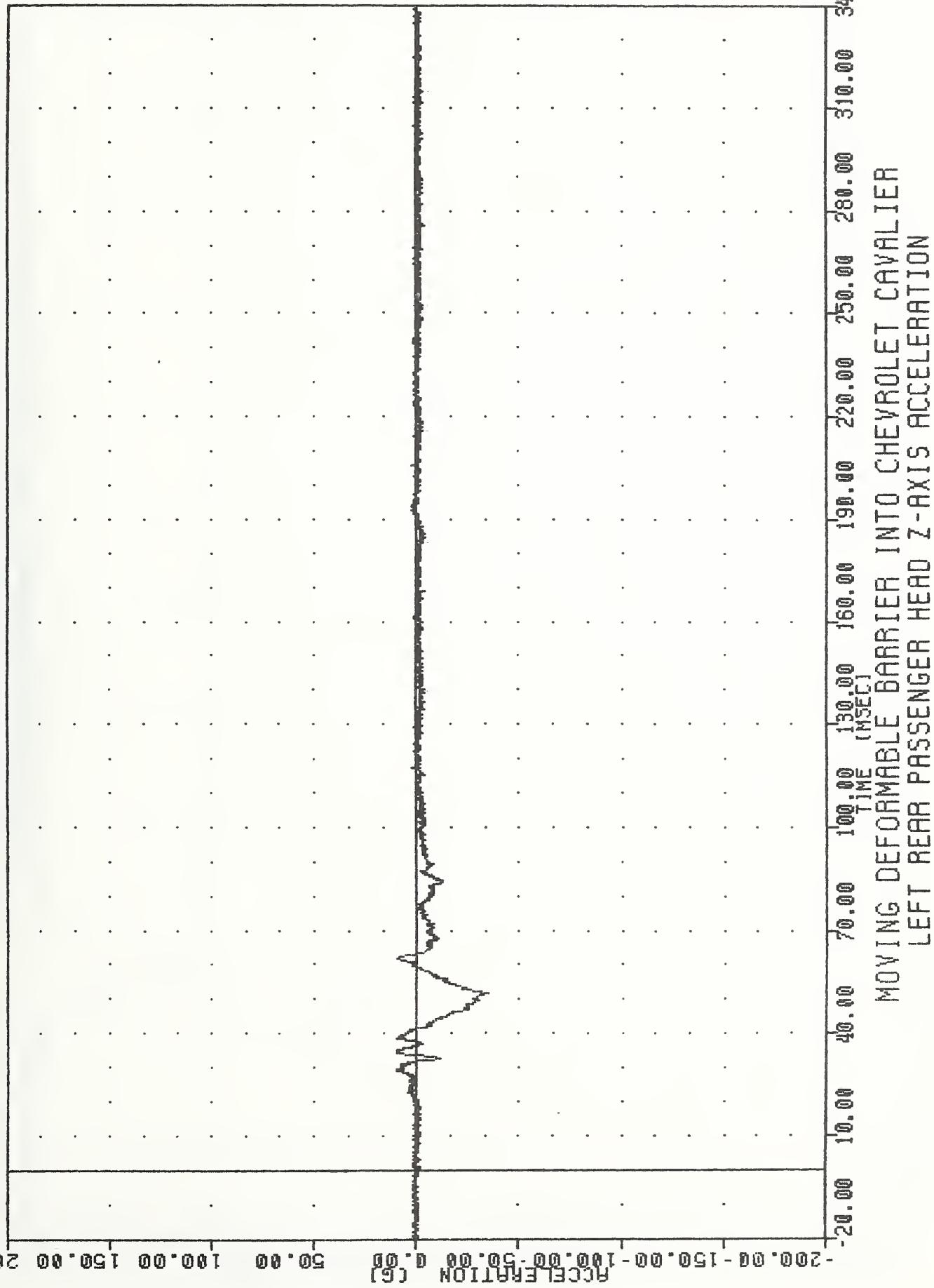
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.458 36.75 , 22.53 & 138.25

-20.00 -10.00 0.00 10.00 20.00 30.00 40.00 50.00 60.00
VELOCITY (MPH)

-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
TIME (SEC)
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER HEAD Y-AXIS VELOCITY

YHTC , 9W0604
SI PROTECTION PROD VEHICLE
90154
HEDZ64

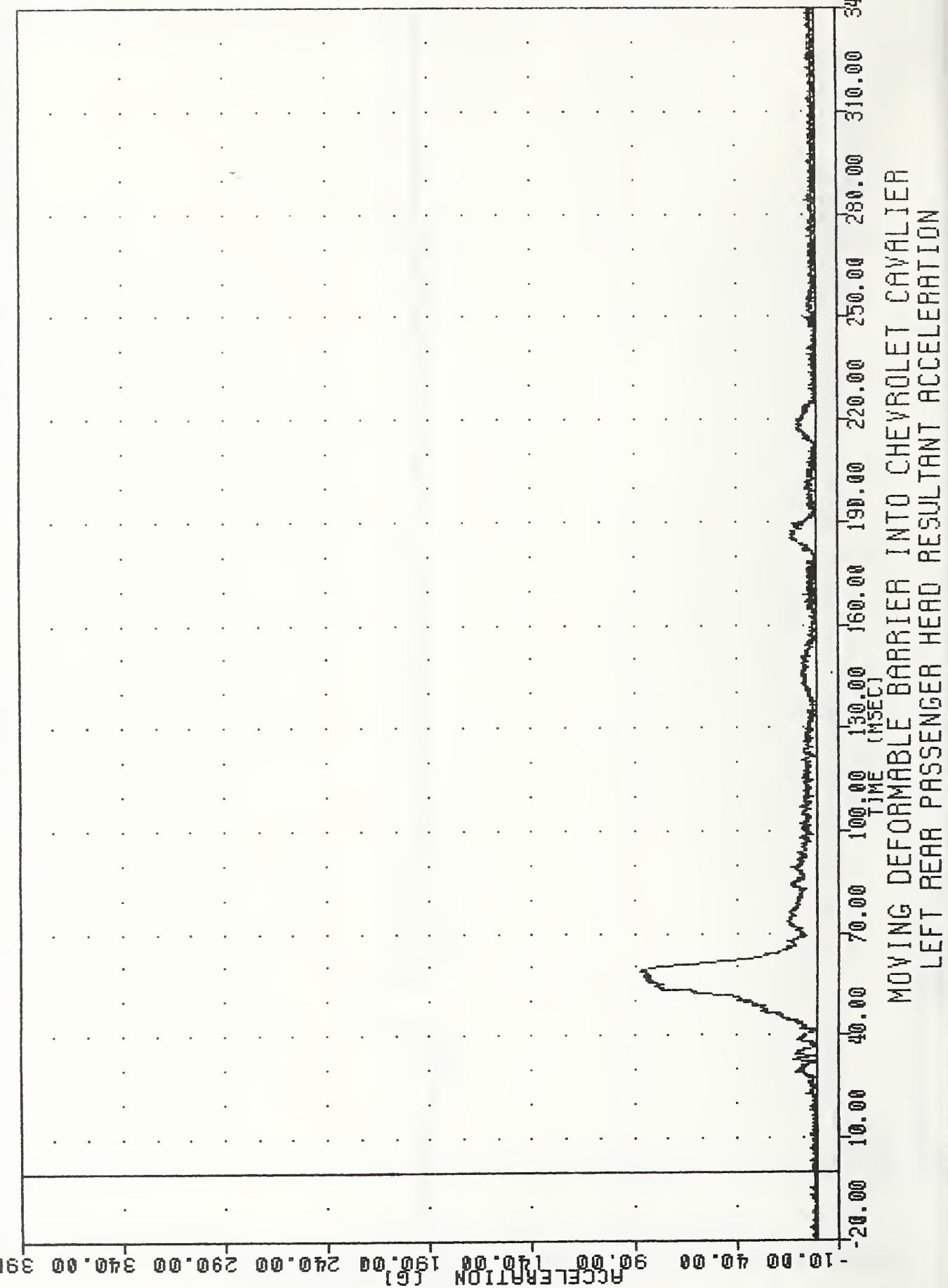
FILTER = RLPP 1650/ 5214/ -40
MIN, MAX VALUES = -34.43@ 51.75 , 10.23 @ 34.50



VRTC
SI PROTECTION PROD VEHICLE
90154
HEORG4

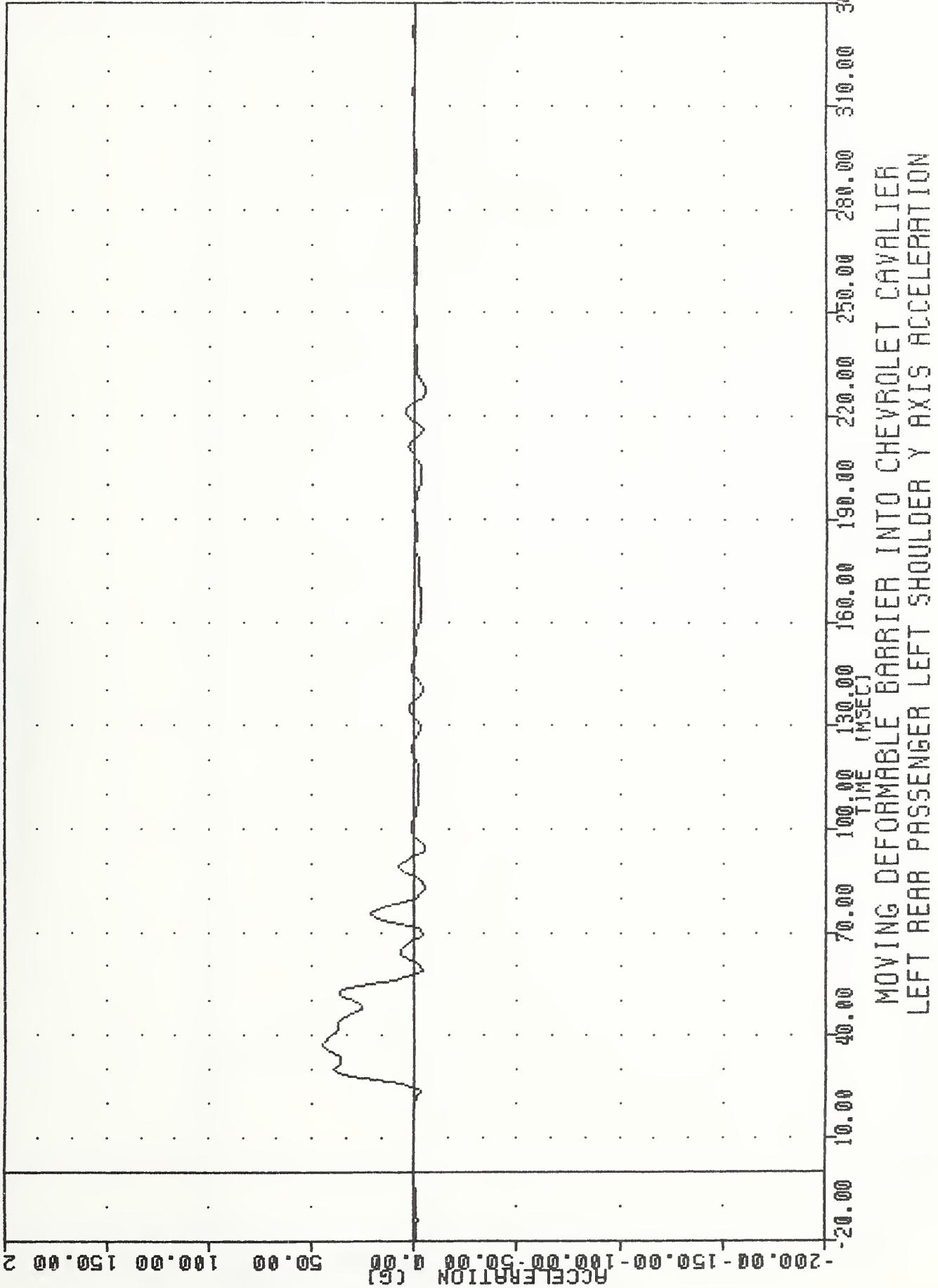
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = 0.208 -17.50 ,

87.56 8 58.75



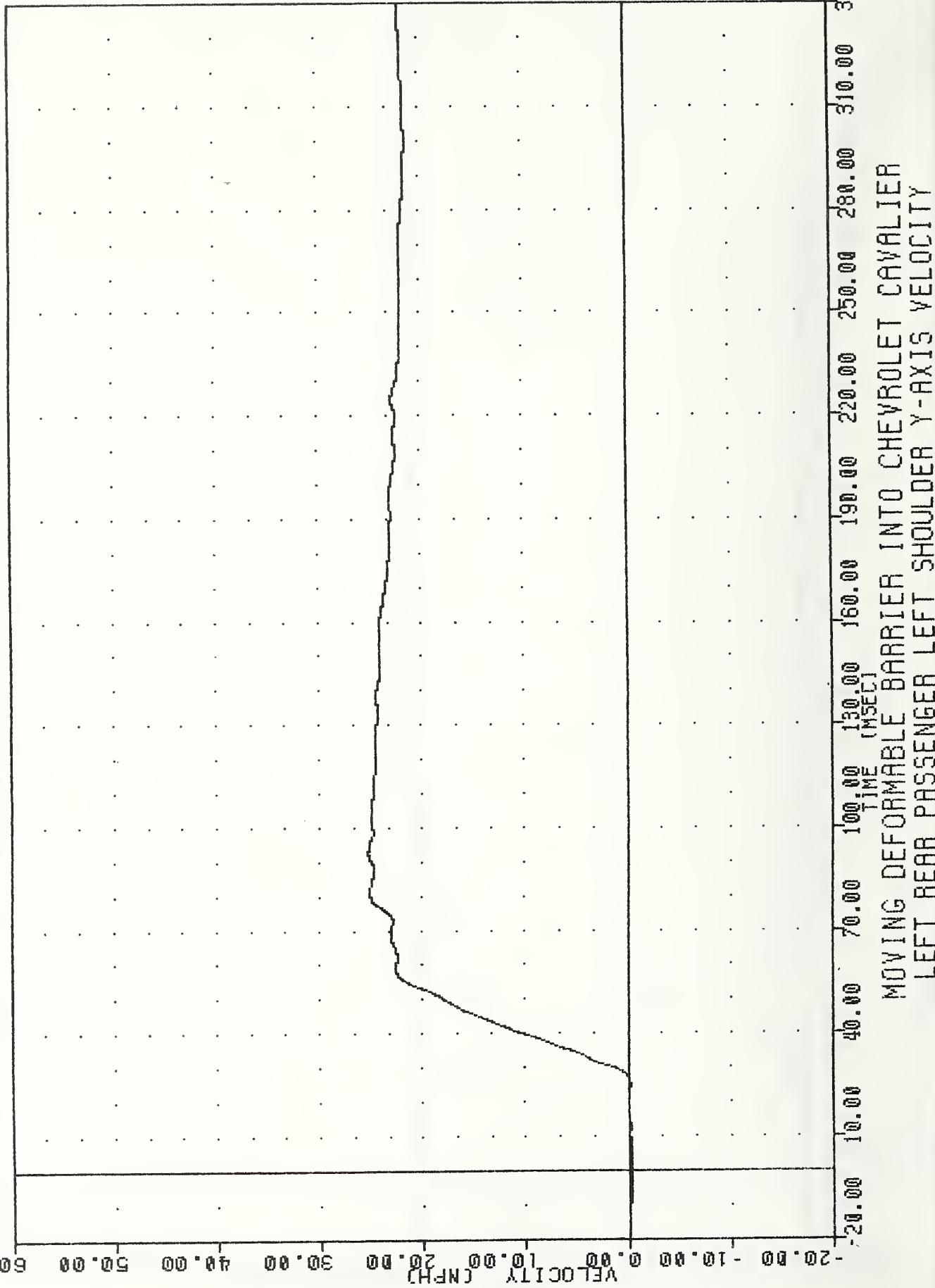
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
SHLY64

FILTER = HSFL 136/ 189/ -50
MIN, MAX VALUES = -5.388 94.388 44.548 37.500



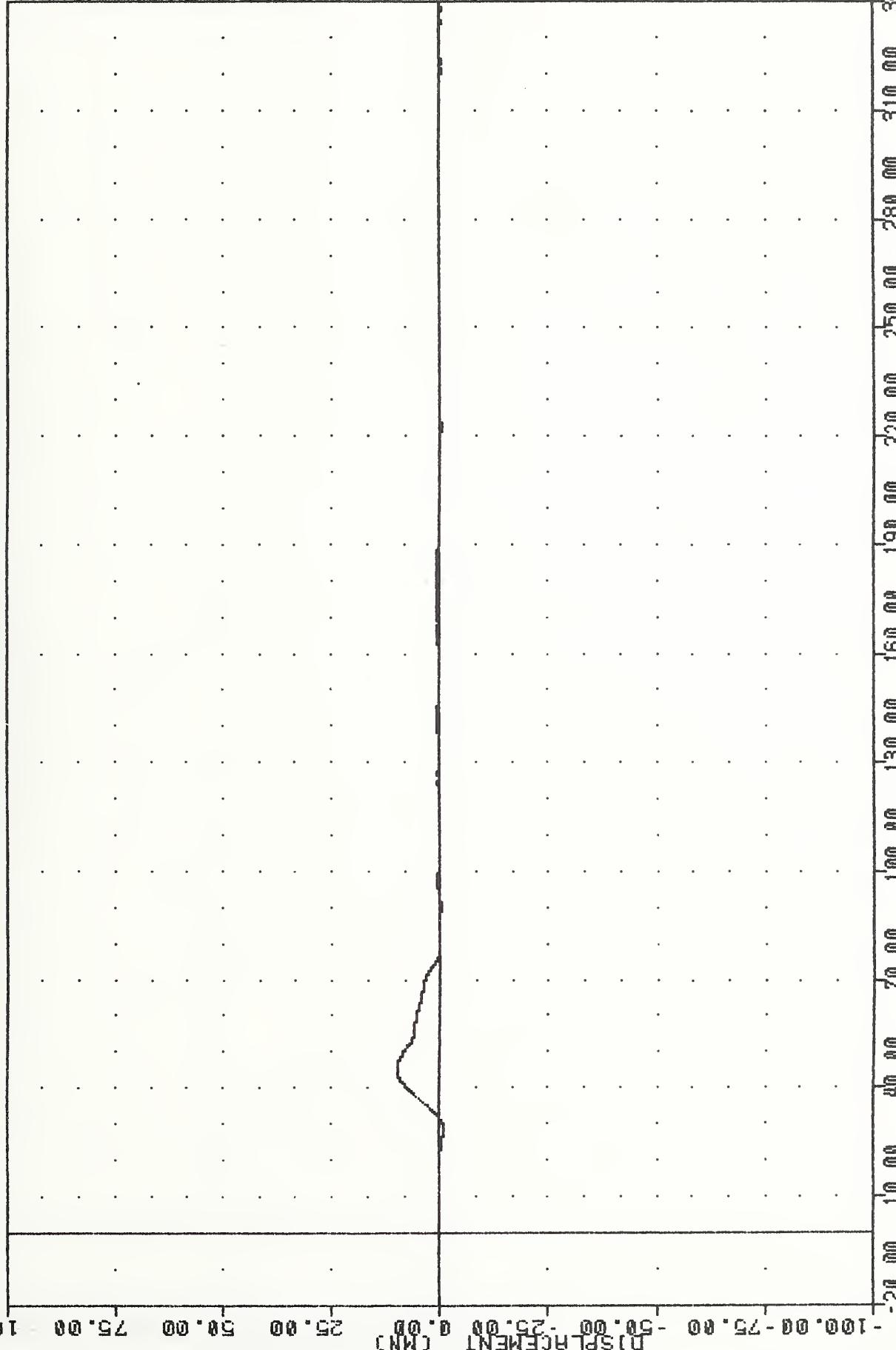
VRTC
SI PROTECTION PHOD VEHICLE
9@154
3HLY44

FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -0.288 -1.25 , 25.27 @ 92.38



VRTC 900604
SI PROTECTION PROD VEHICLE
90154 SHLY04

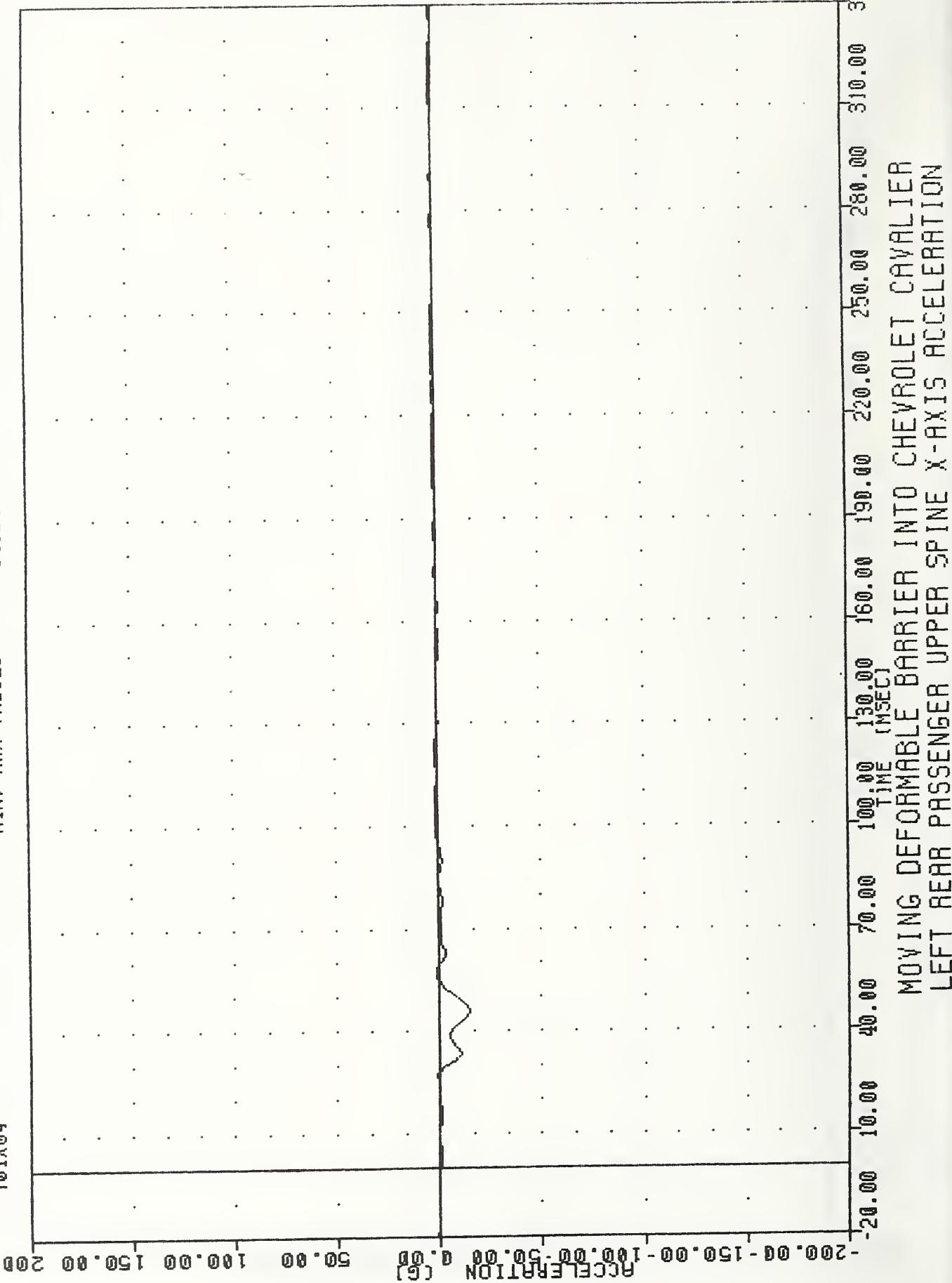
FILTER = BLPF 300/
MIN, MAX VALUES = -0.868 28.63
9.80 8 44.75



100.00 -75.00 50.00 25.00 0.00 -50.00 -75.00 -100.00
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
TIME (ms)
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT SHOULDER TO SPINE DISPLACEMENT

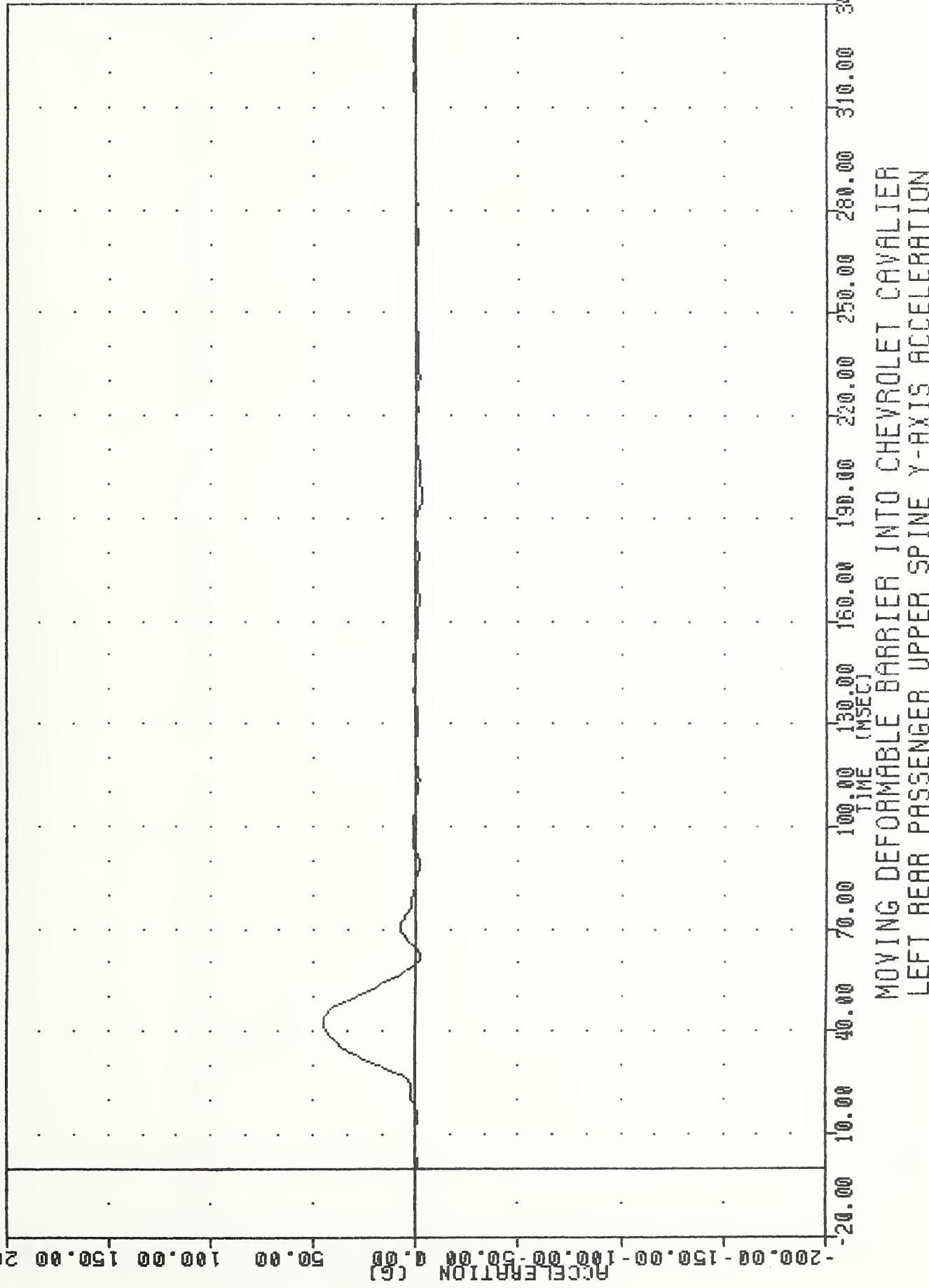
VRTC
SI PROTECTION POD VEHICLE
90154
101X64

FILTER = HSFL 136/
MIN, MAX VALUES = -14.248 46.25 ,
1.85 & 237.50



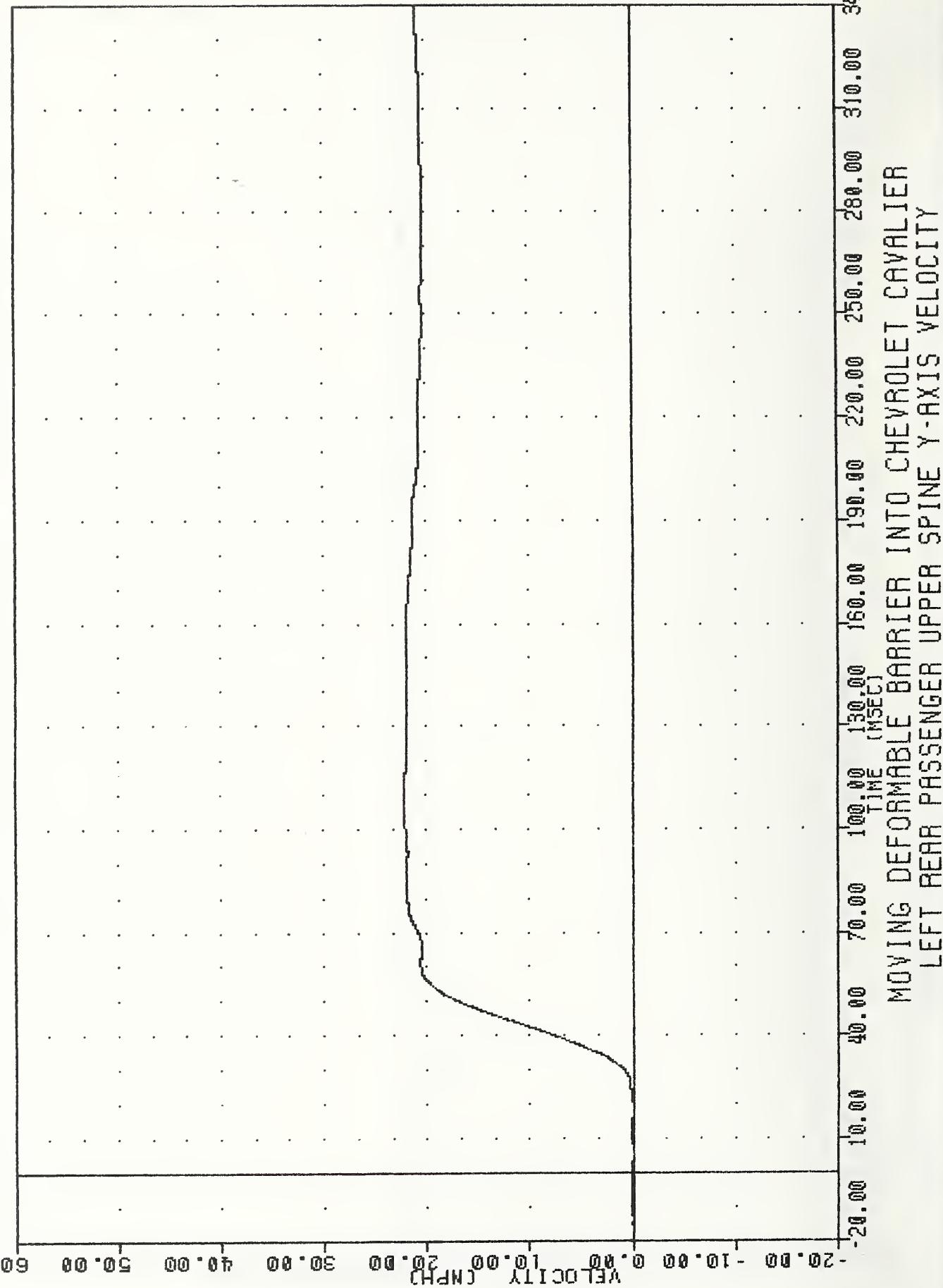
YRTC, 900604
SI PROTECTION PROD VEHICLE
90154 101Y64

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -2.878 196.25 , 45.32 @ 42.50



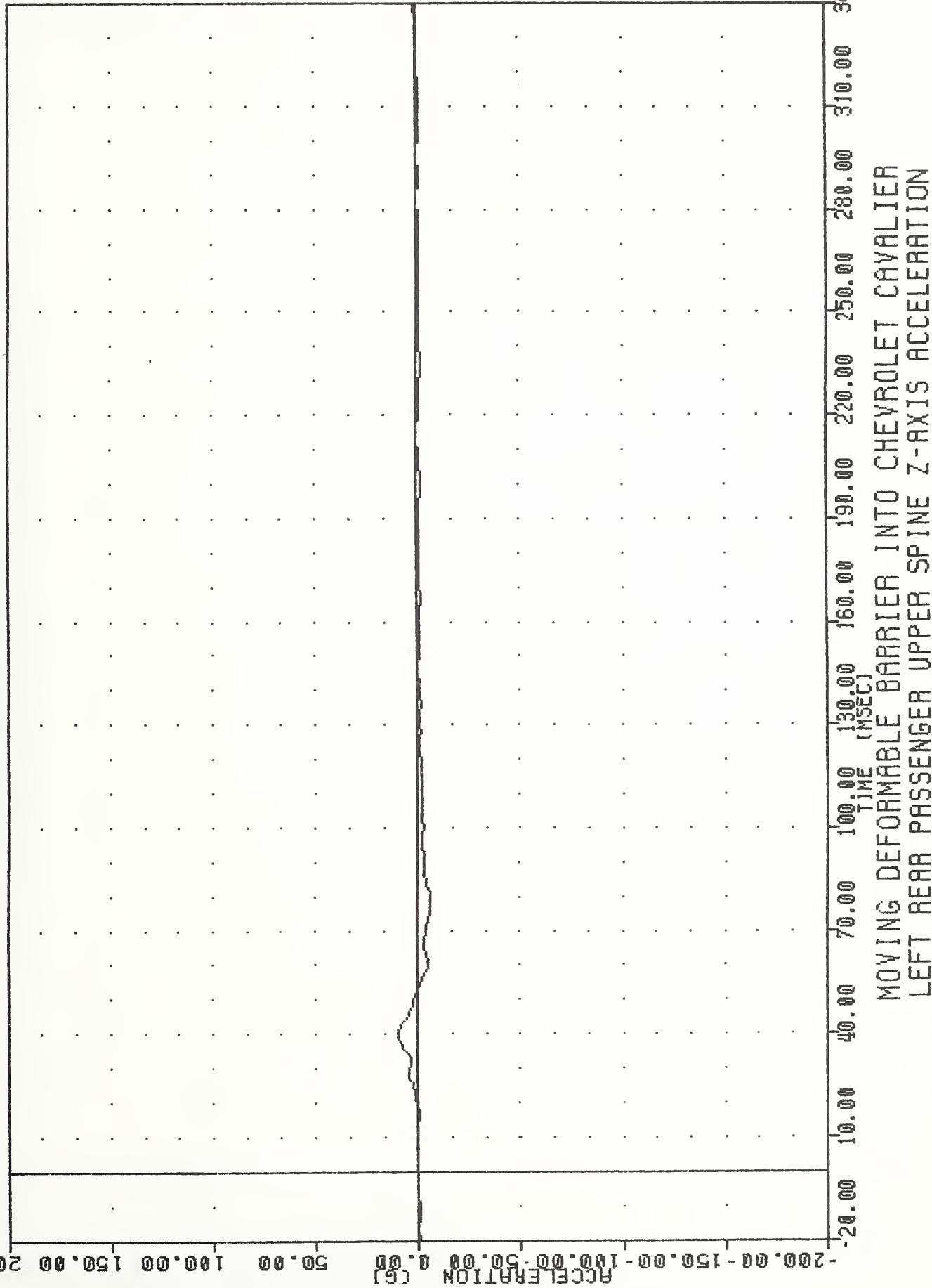
YRTC 900604
SI PROTECTION PROD VEHICLE
90154
101YY4

FILTER = BLFF 3000/ 9449/ -40
MIN, MAX VALUES = -0.018 18.50 , 22.22 & 108.38



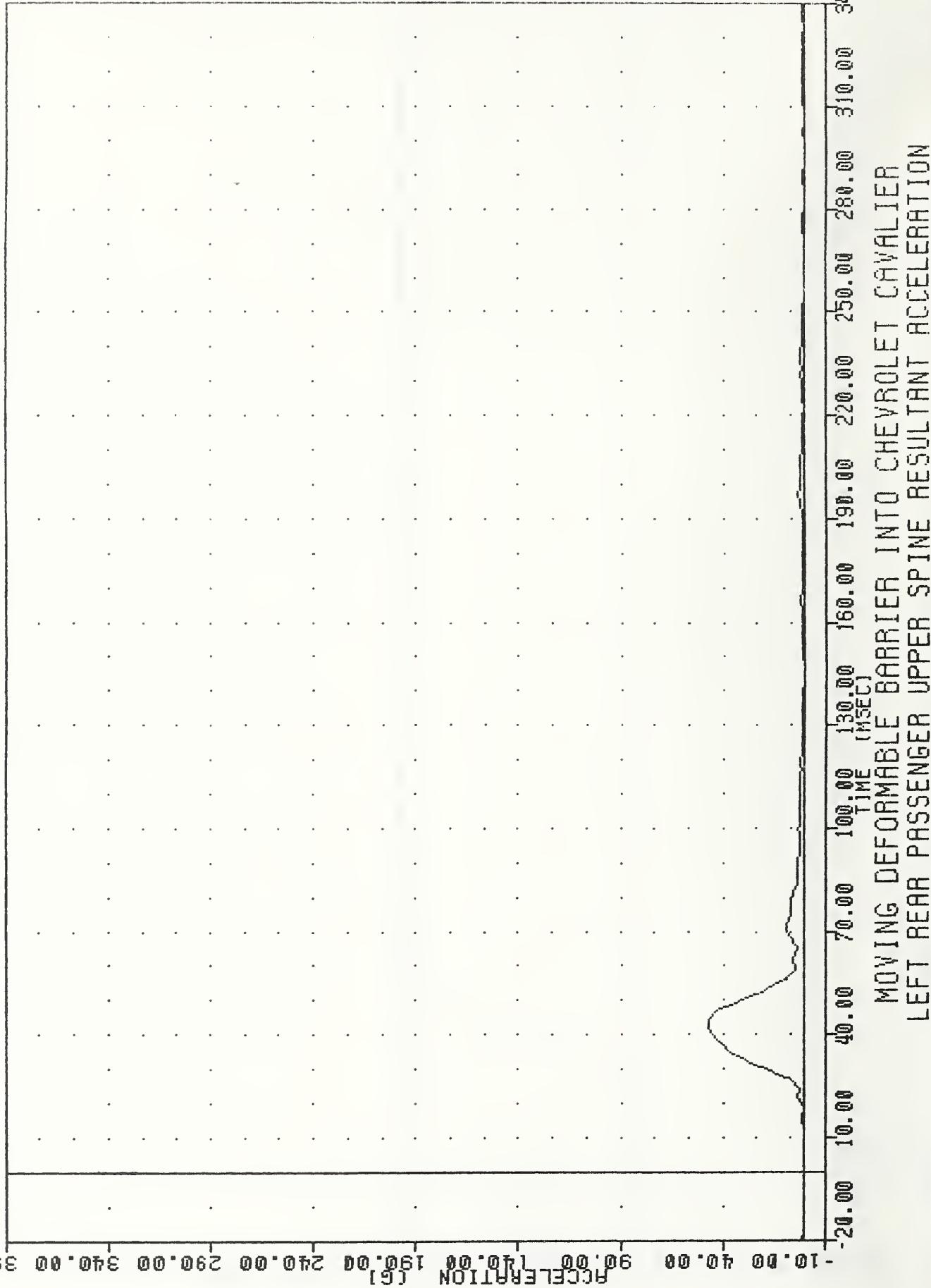
YRTC, 900604
SI PROTECTION FROM VEHICLE
30154
101764

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -6.498 77.50 , 9.80 & 40.00



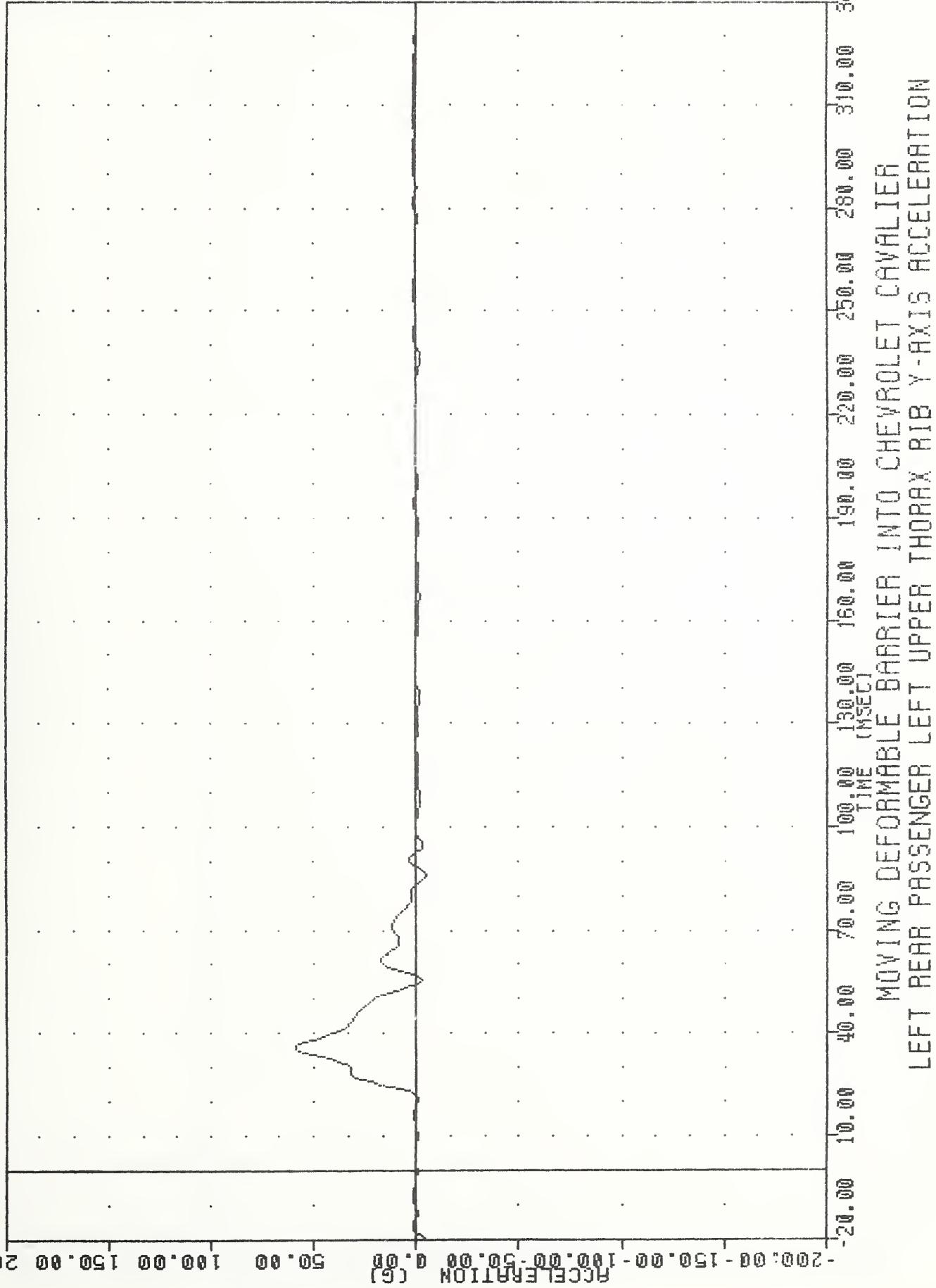
VRTC 900604
SI PROTECTION PROD VEHICLE
90154 101RG4

FILTER = HSRI
MIN, MAX VALUES = 136/ 189/ -50
0.028 -17.50 , 47.26 & 43.13



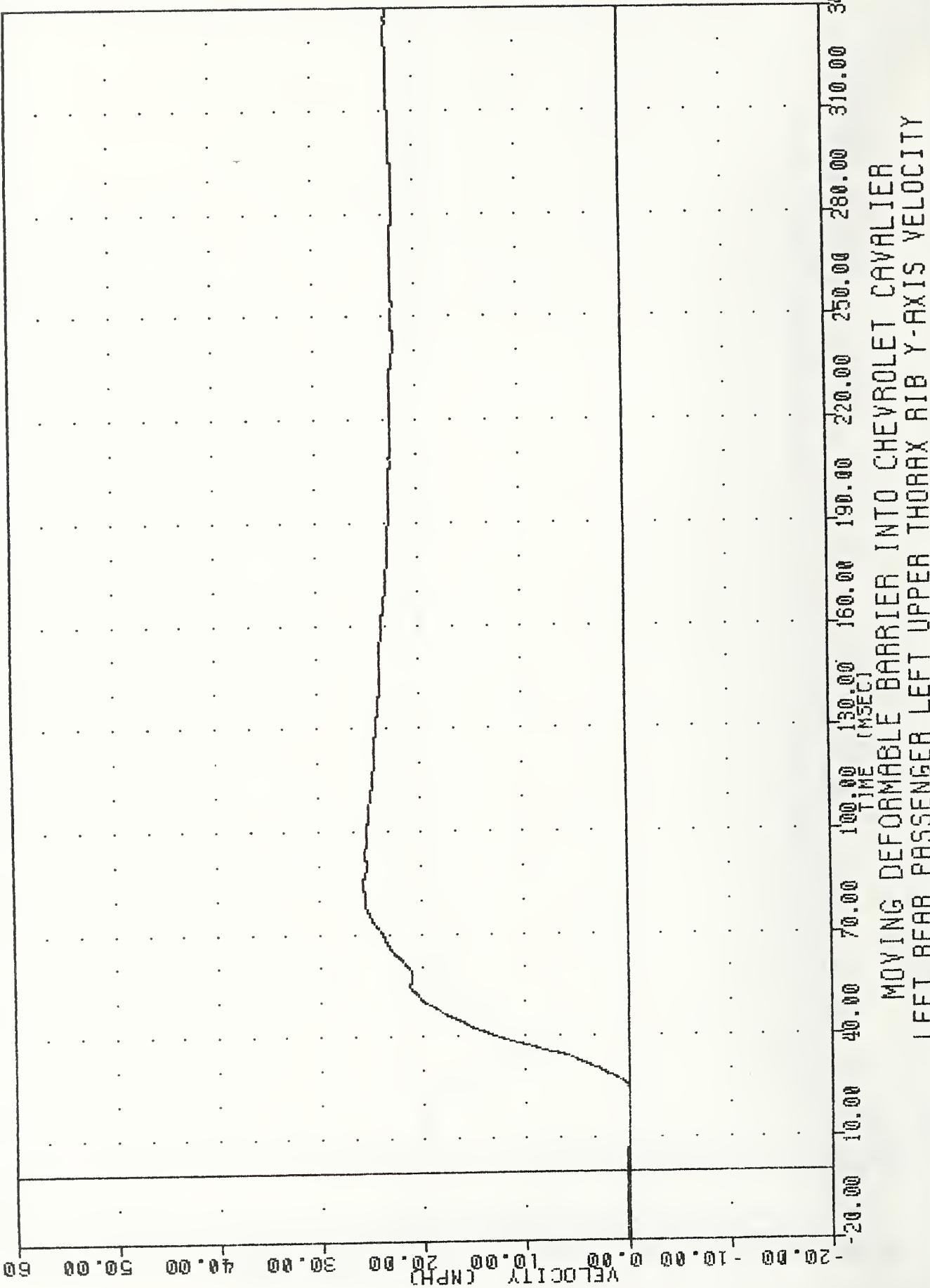
WRTC , 900604
SI PROTECTION PROD VEHICLE
90154
LURY64

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -4.99 , -20.00 , 56.88 & 35.63



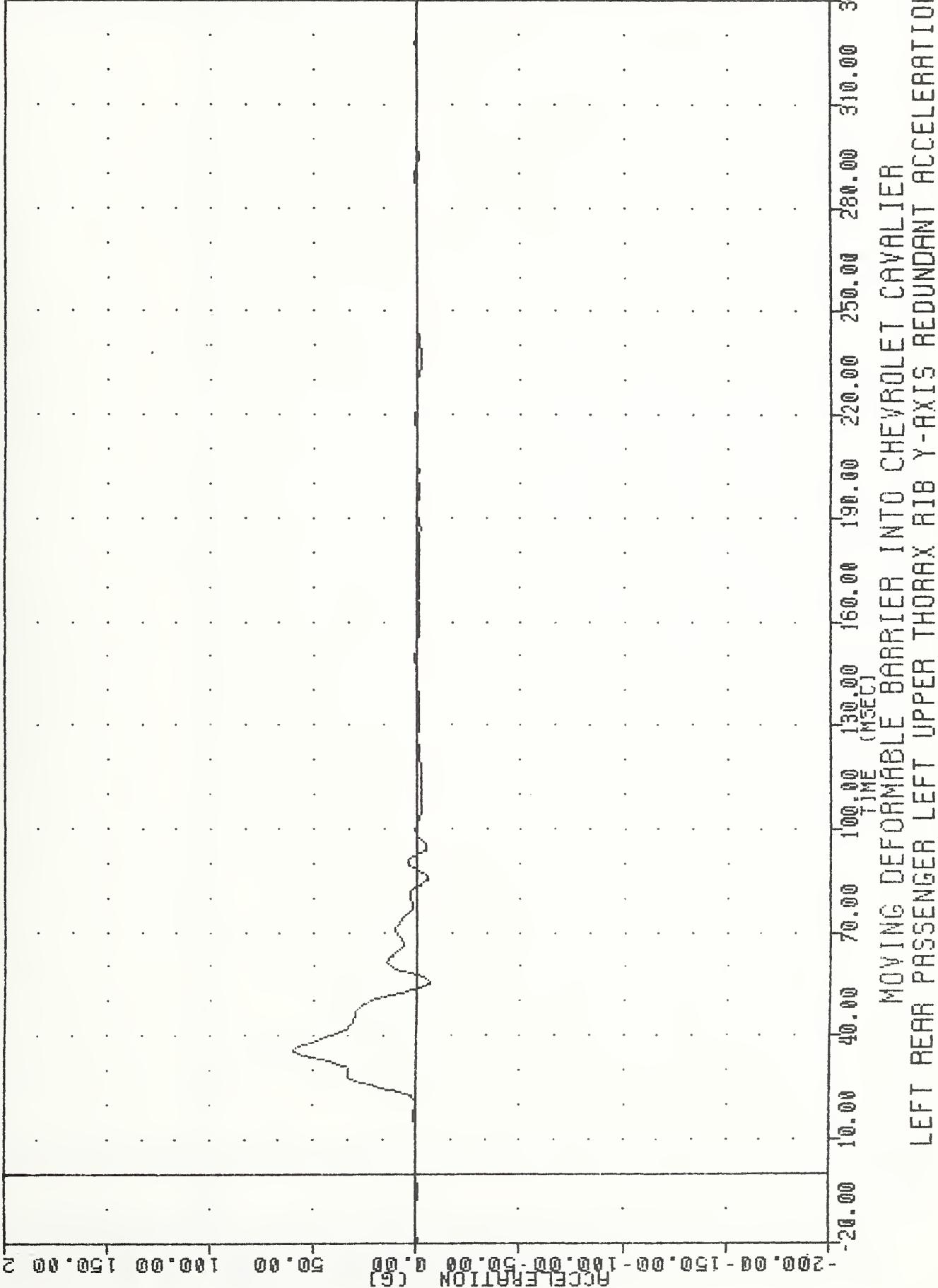
YRTC , 900604
SI PROTECTION PROD VEHICLE
90154 LURRY4

FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -0.128 14.00 . 25.83 @ 84.50



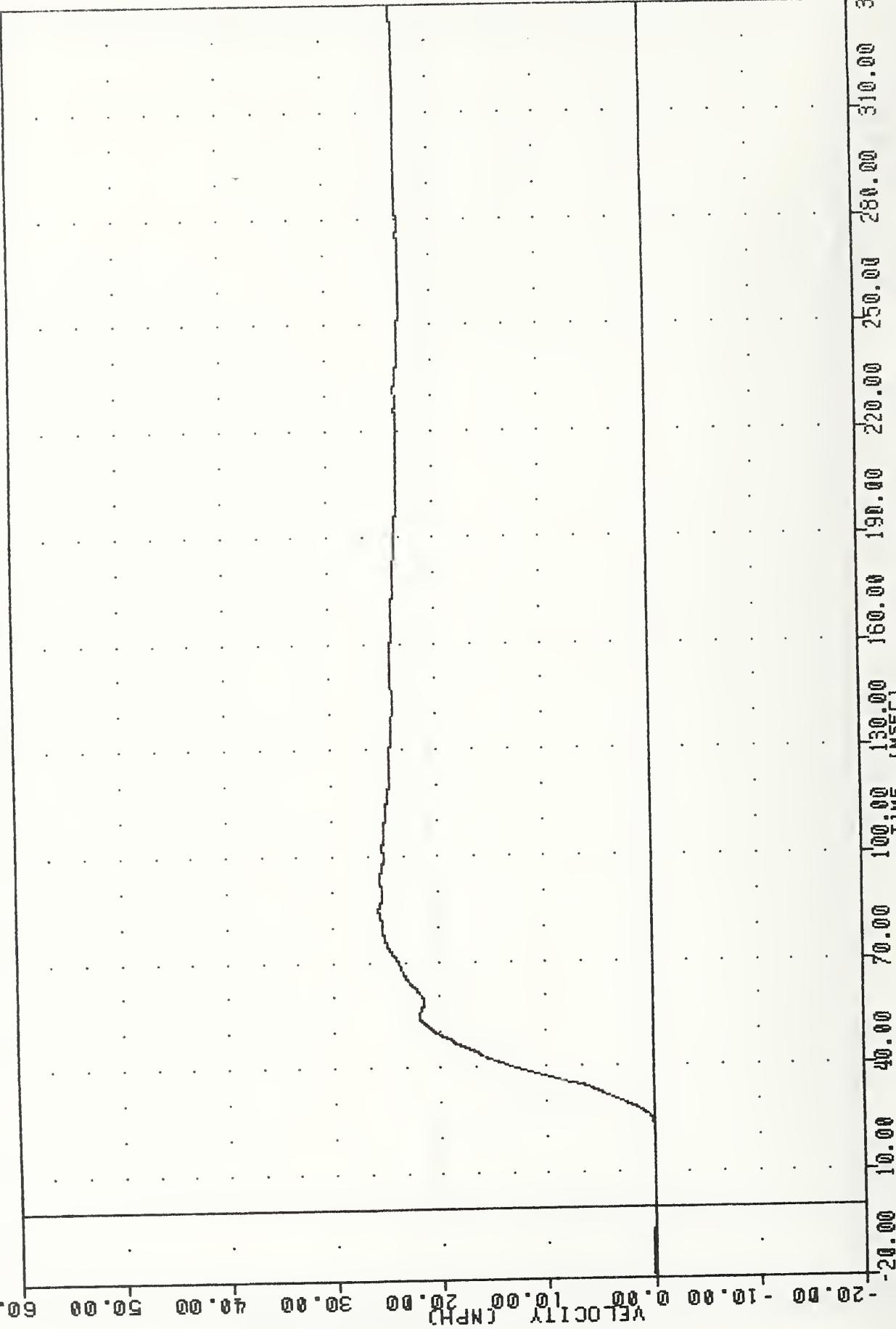
VRTC , 900004
SI PROTECTION PROD VEHICLE
90154
LURY60

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -6.548 55.63 , 59.12 & 35.63



YRTC , 900604
SI PROTECTION PROD VEHICLE
90154 LURRYVO

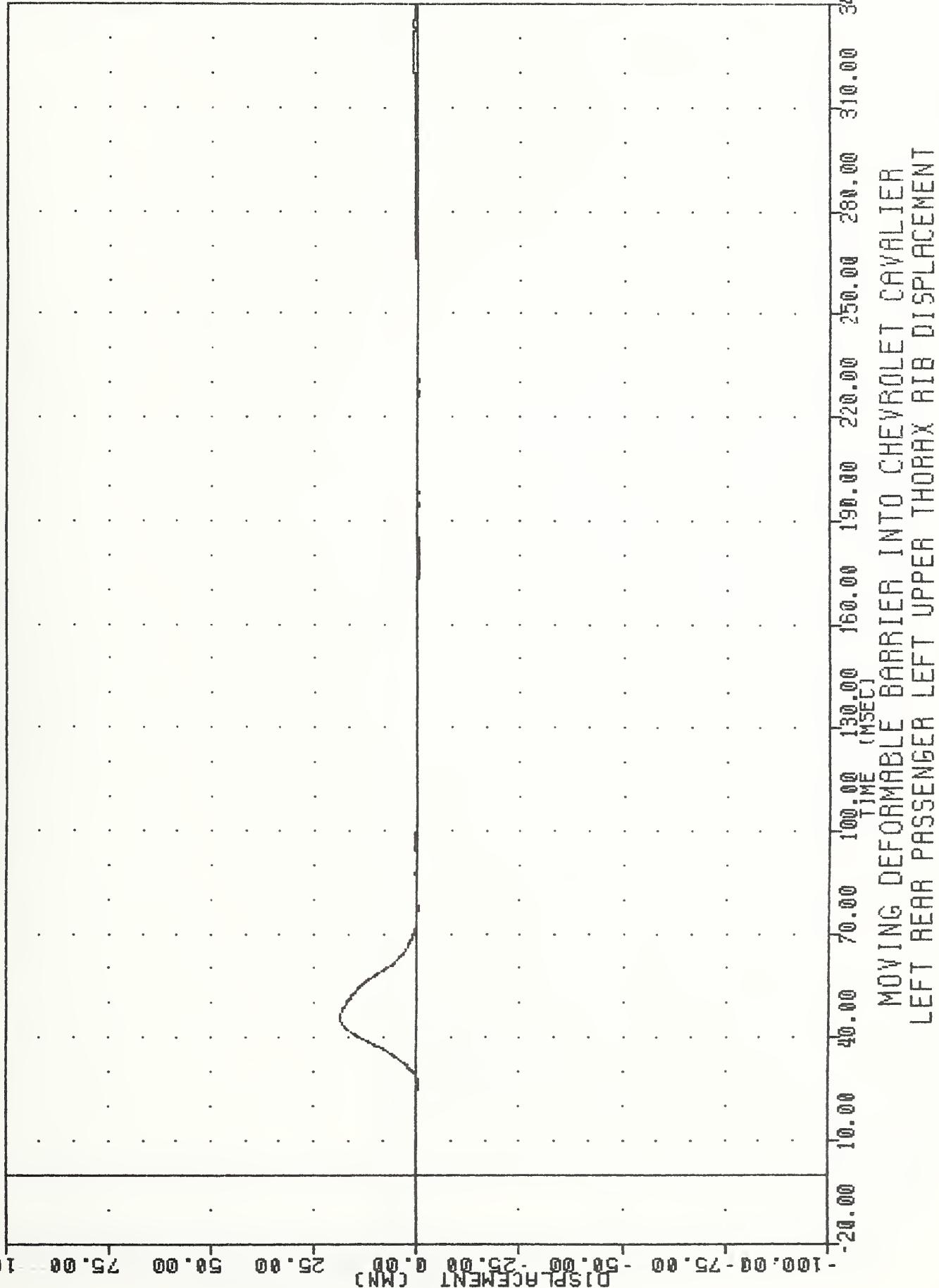
FILTER = BLFF 300/ 949/ -40
MIN, MAX VALUES = -0.158 15.00 , 25.68 & 84.63



Moving deformable barrier into Chevrolet Cavalier
Left rear passenger left upper thorax rib y-axis redundant velocity

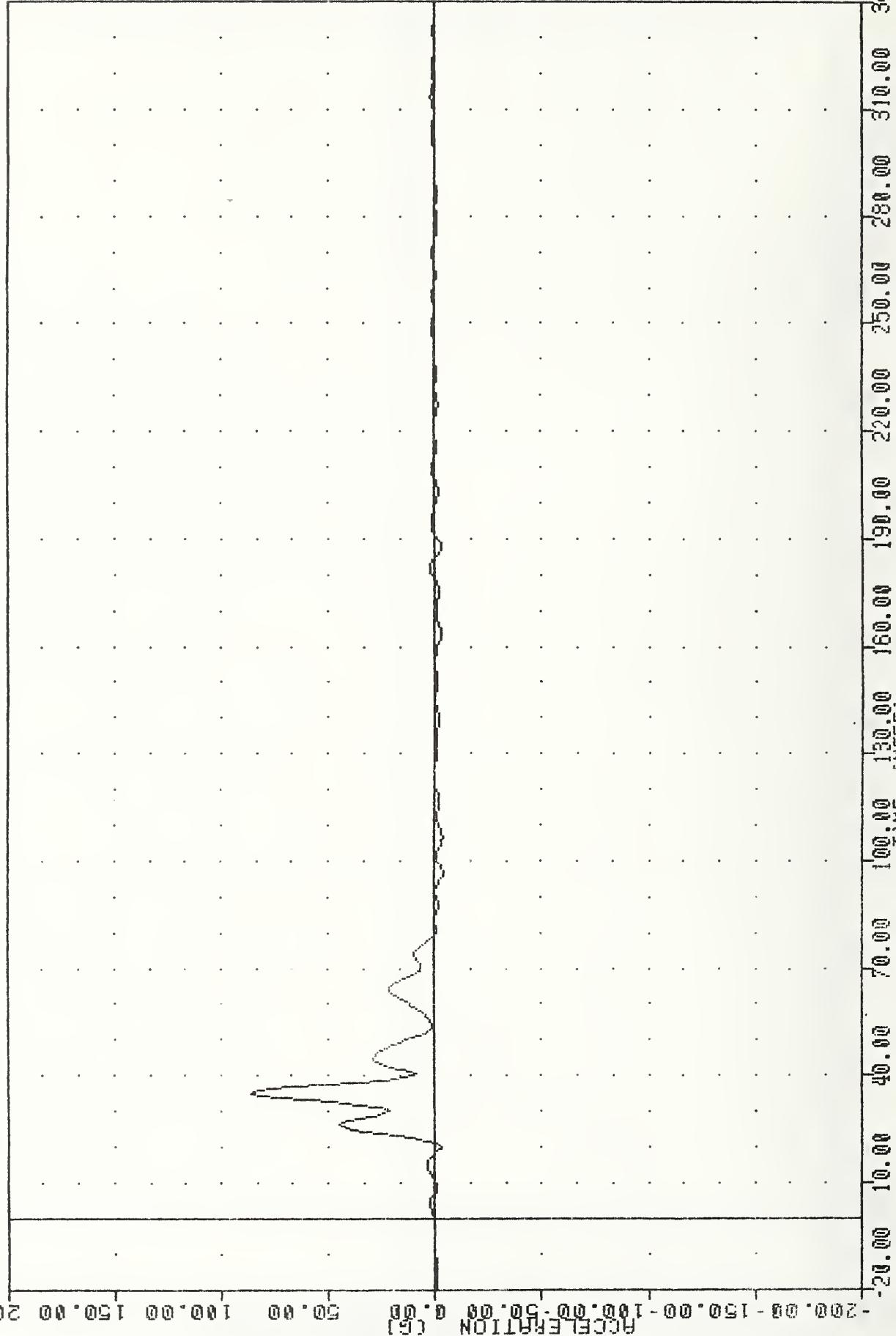
YRTC 900604
SI PROTECTION PROD VEHICLE
90154 LURYD4

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.268 177.50 , 18.62 & 45.88



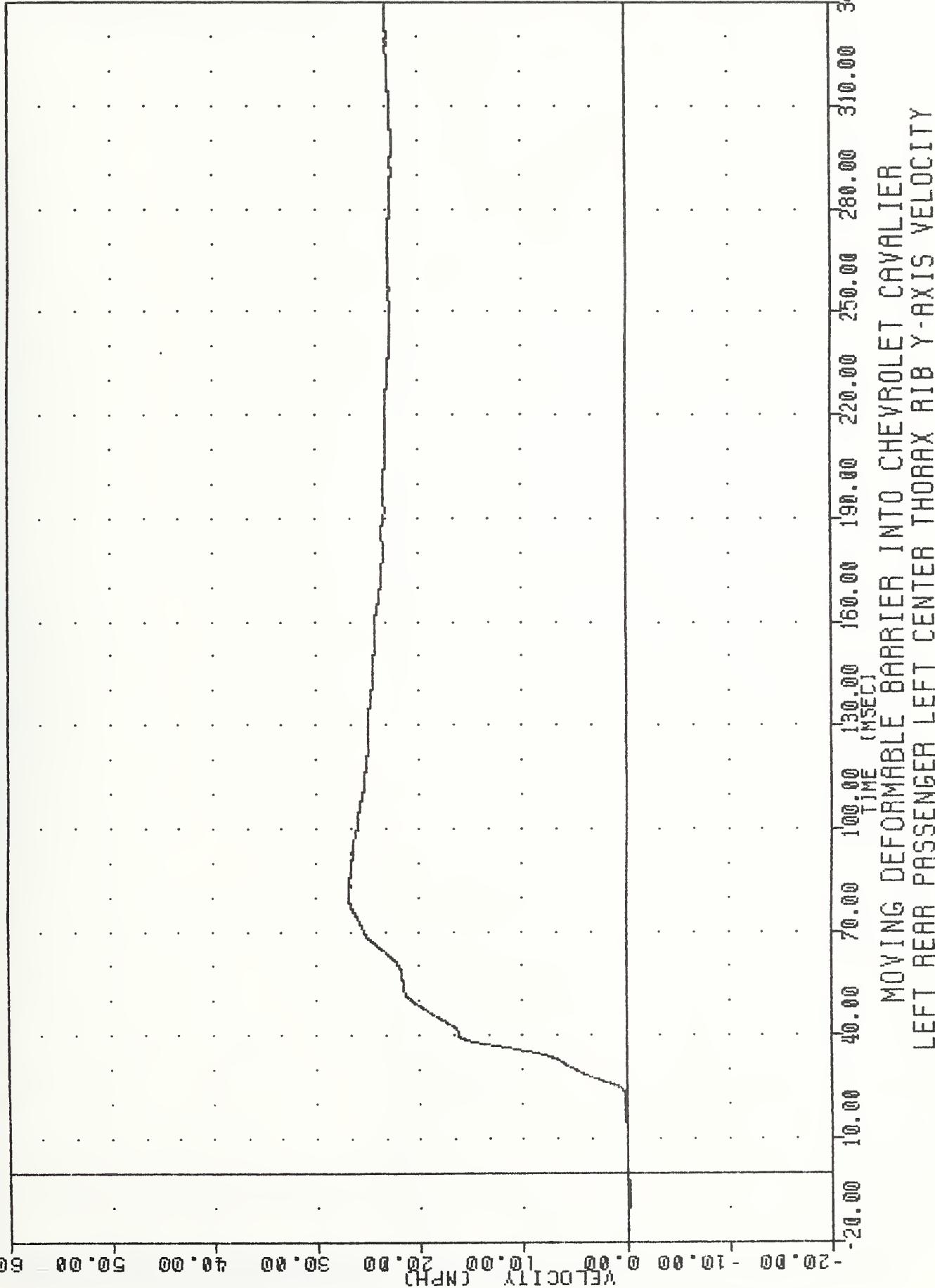
YRTC
SI PROTECTION FROM VEHICLE
9@154
LCRY64

FILTER = HSPRI 136/ 189/-50
MIN, MAX VALUES = -3.978 96.88 , 86.37 @ 35.00



VRTC 900604
SI PROTECTION PROD VEHICLE
90154
LCRYY4

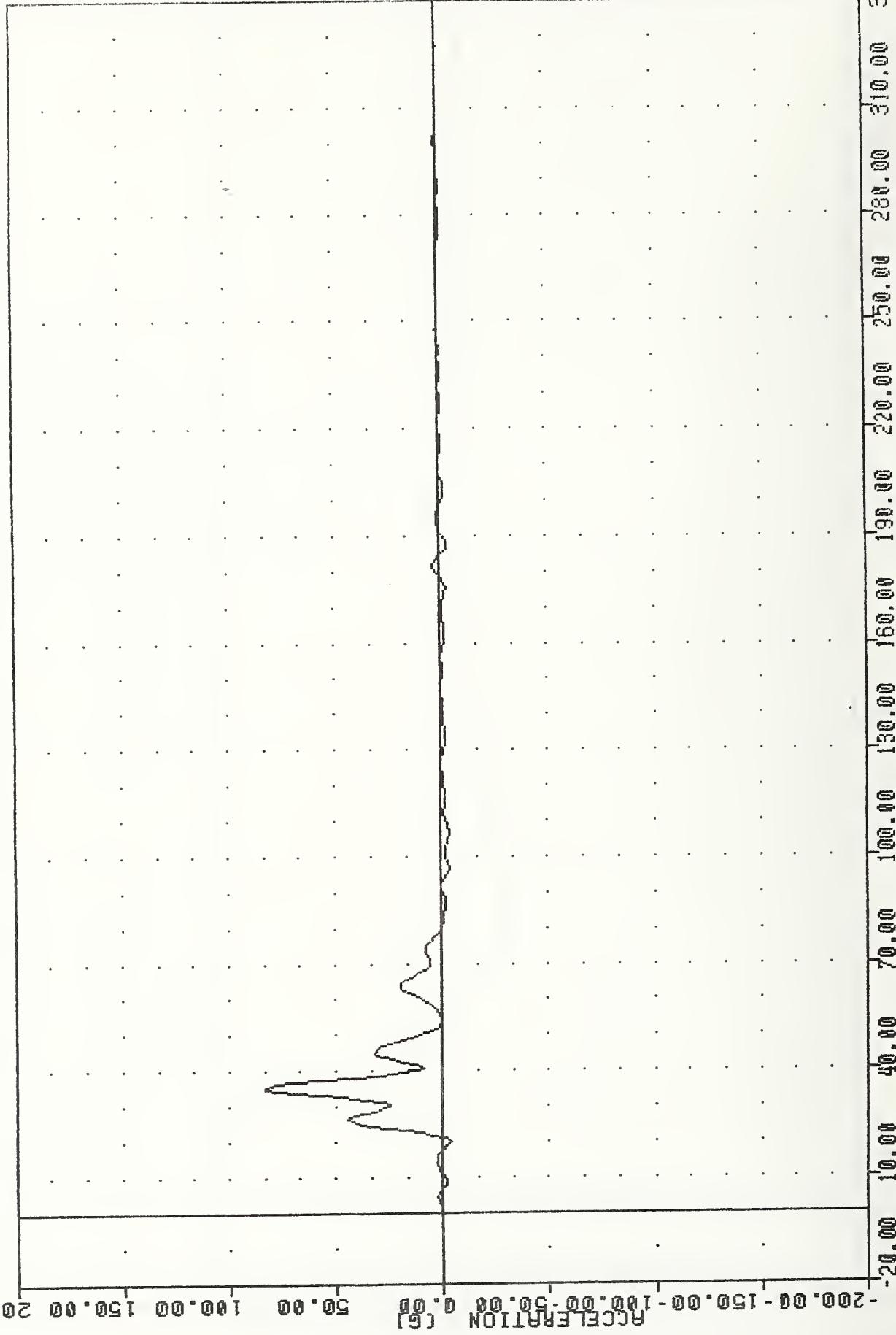
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.228 -7.75
26.81 8 80.13



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT CENTER THORAX RIB Y-AXIS VELOCITY

VRTC
SI PROTECTION PASS VEHICLE
9@154
LCRYGD

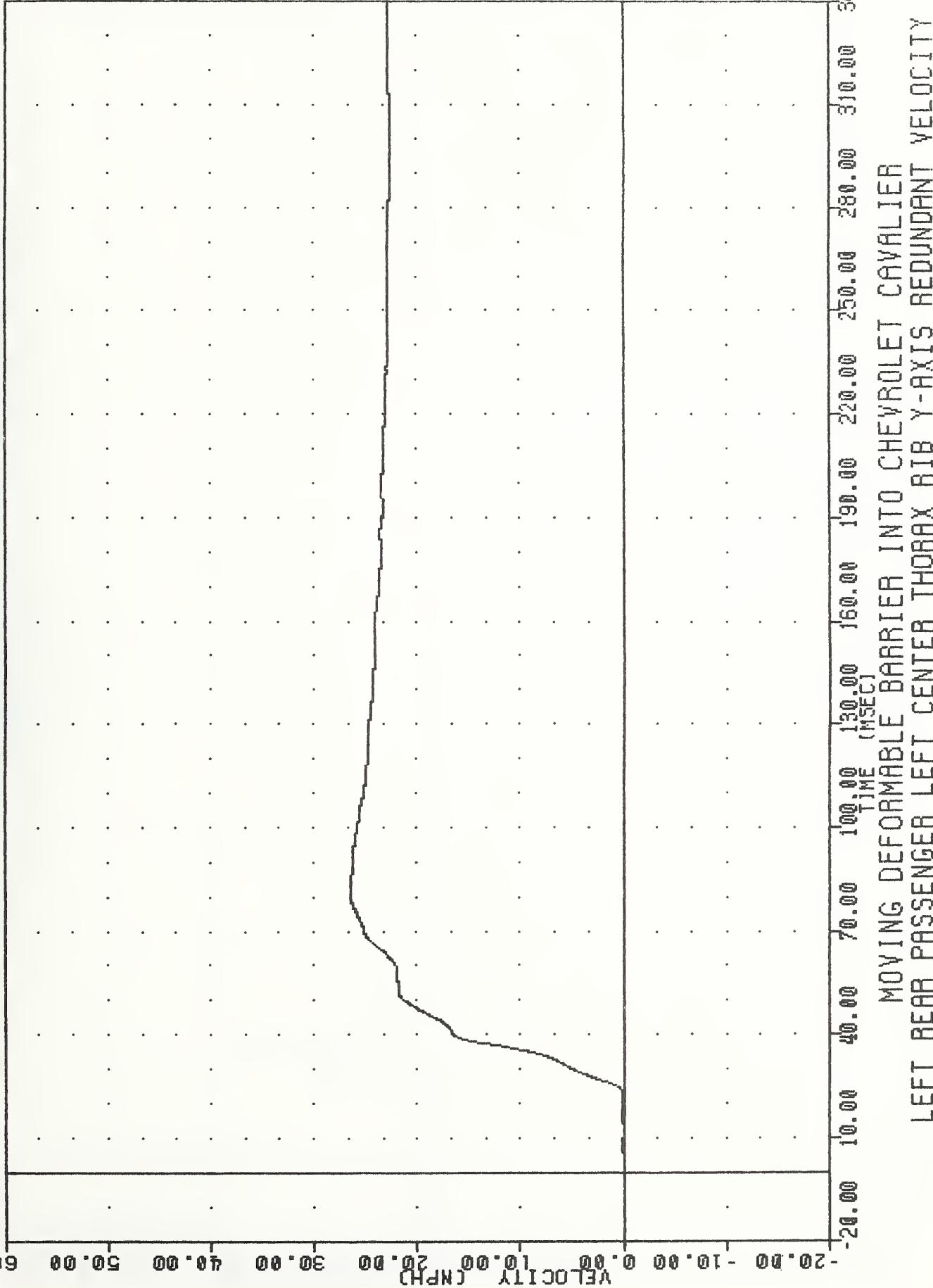
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -3.848 106.87
 83.12 8 35.63



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT CENTER THORAX RIB Y-AXIS REDUNDANT ACCEL

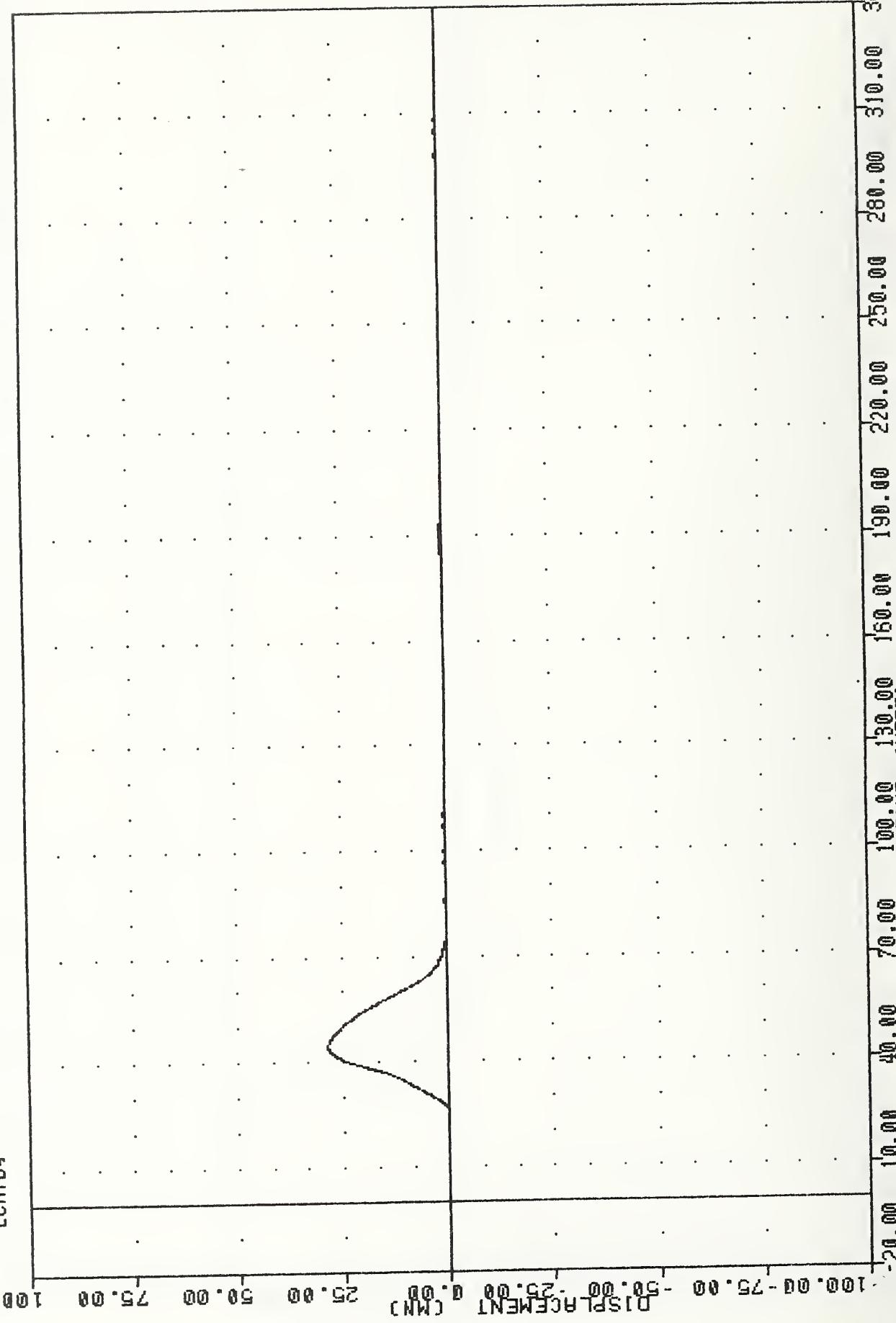
VRTC
SI PROTECTION PROD VEHICLE
90154
LCRY00

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.0078 2.75
26.41 8 80.50



VRTC , 900604
SI PROTECTION PROD VEHICLE
9@154
LCRY04

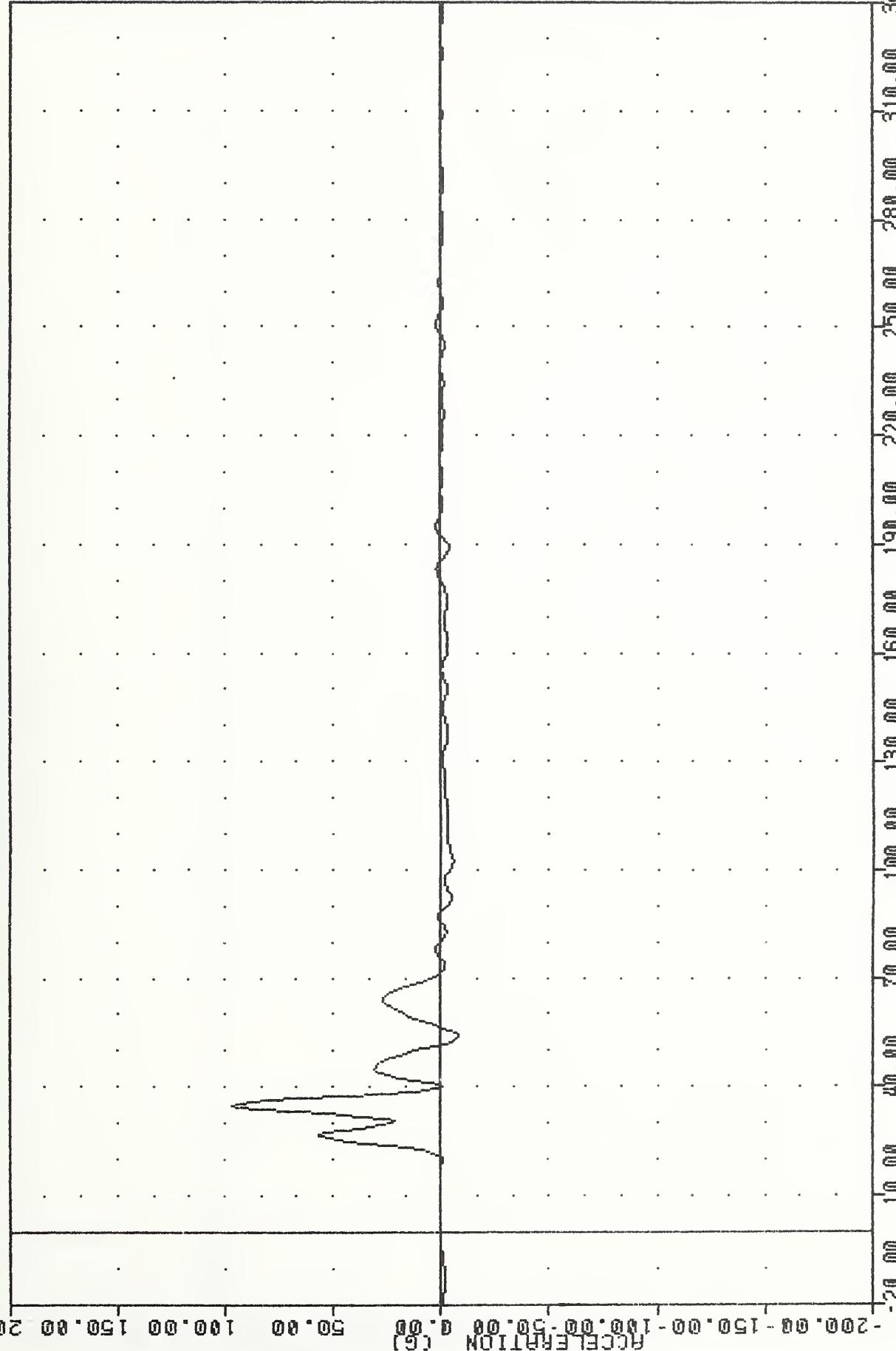
FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -0.008 25.00
28.56 44.38



TIME (msec)
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT CENTER THORAX RIB DISPLACEMENT

VRTC 900604
SI PROTECTION PROD VEHICLE
90154 LLRY64

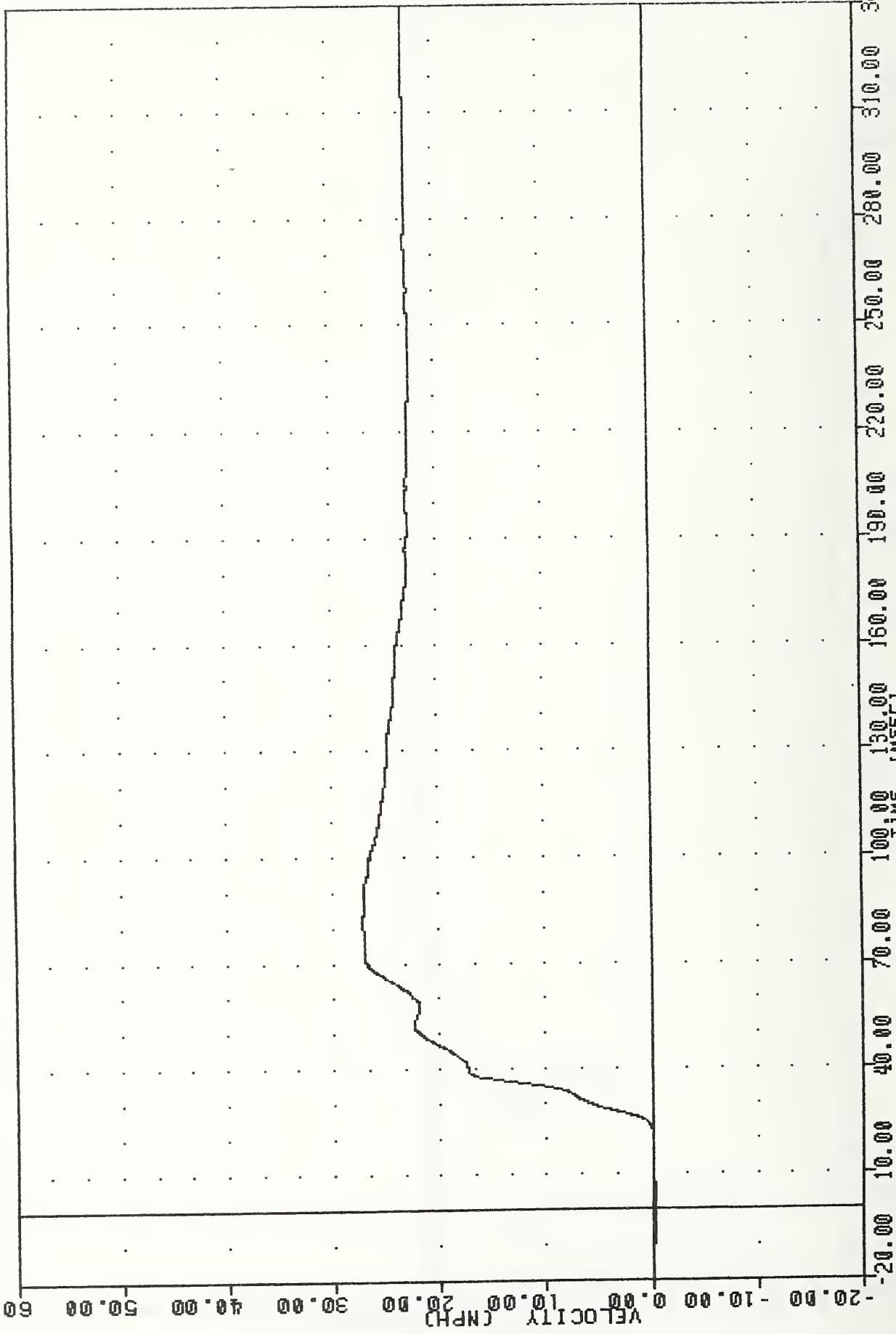
FILTER = HSRL 136/ 189/ -50
MIN, MAX VALUES = -8.048 53.75 , 97.12 & 35.00



TIME (ms)
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT LOWER THORAX RIB Y-AXIS ACCELERATION

VRIC , 900604
SI PROTECTION PROD VEHICLE
9@154
LLRYV4

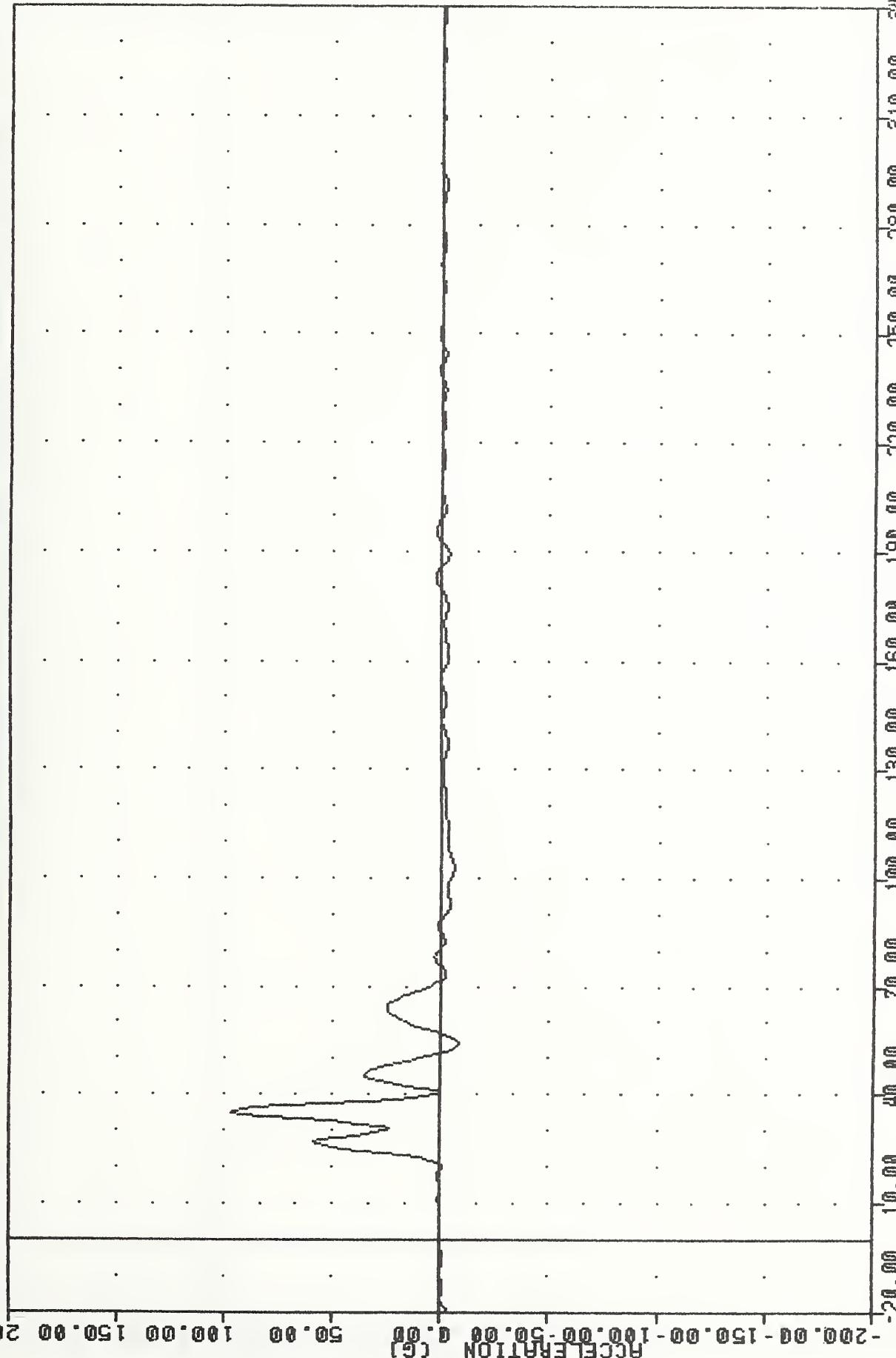
FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -0.318 -4.00 , 27.23 & 81.63



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT LOWER THORAX RIB Y-AXIS VELOCITY

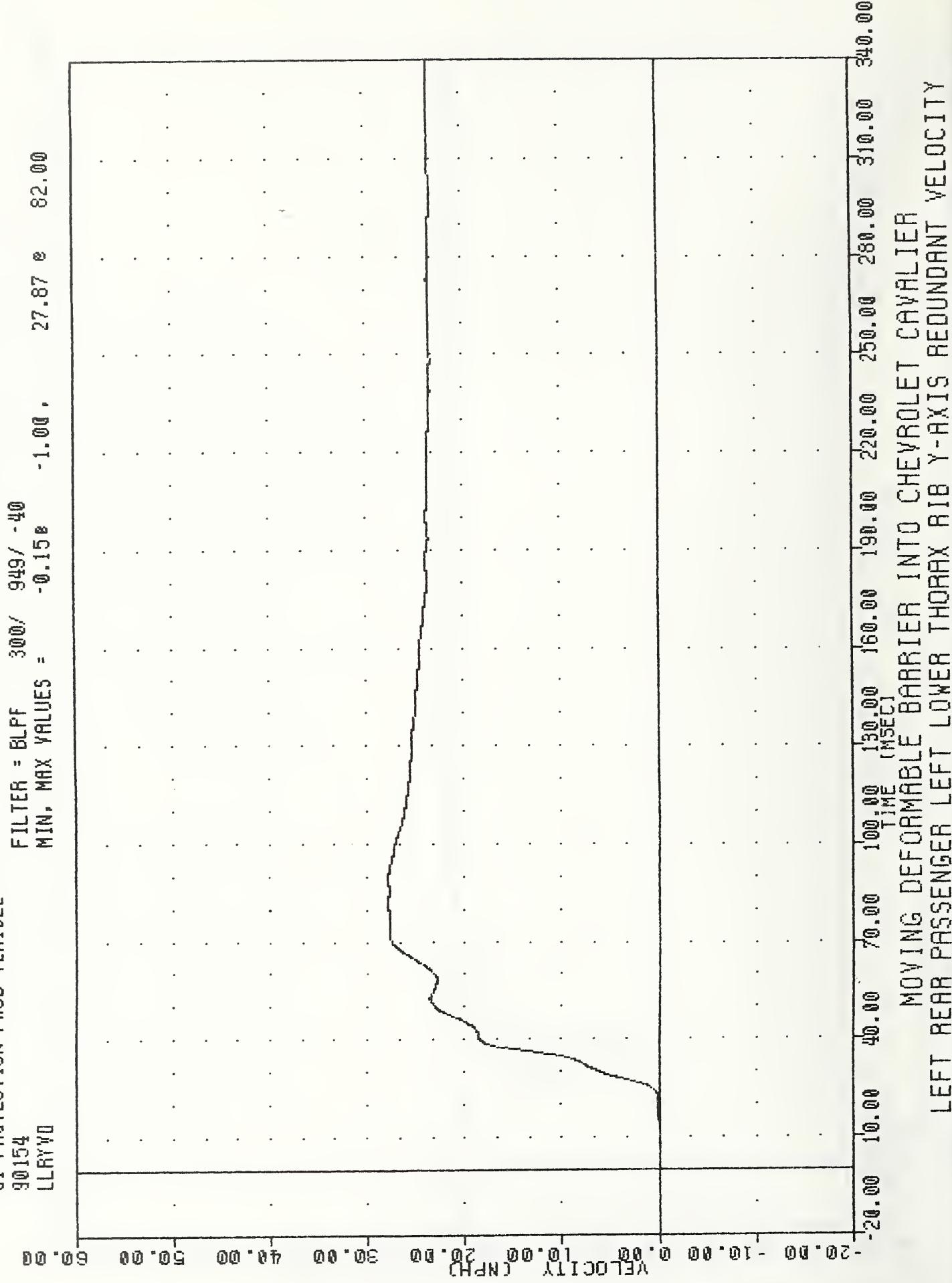
VRTC '900604
SI PROTECTION PROD VEHICLE
90154
LLRY60

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -8.408 53.75 , 97.17 0 35.00



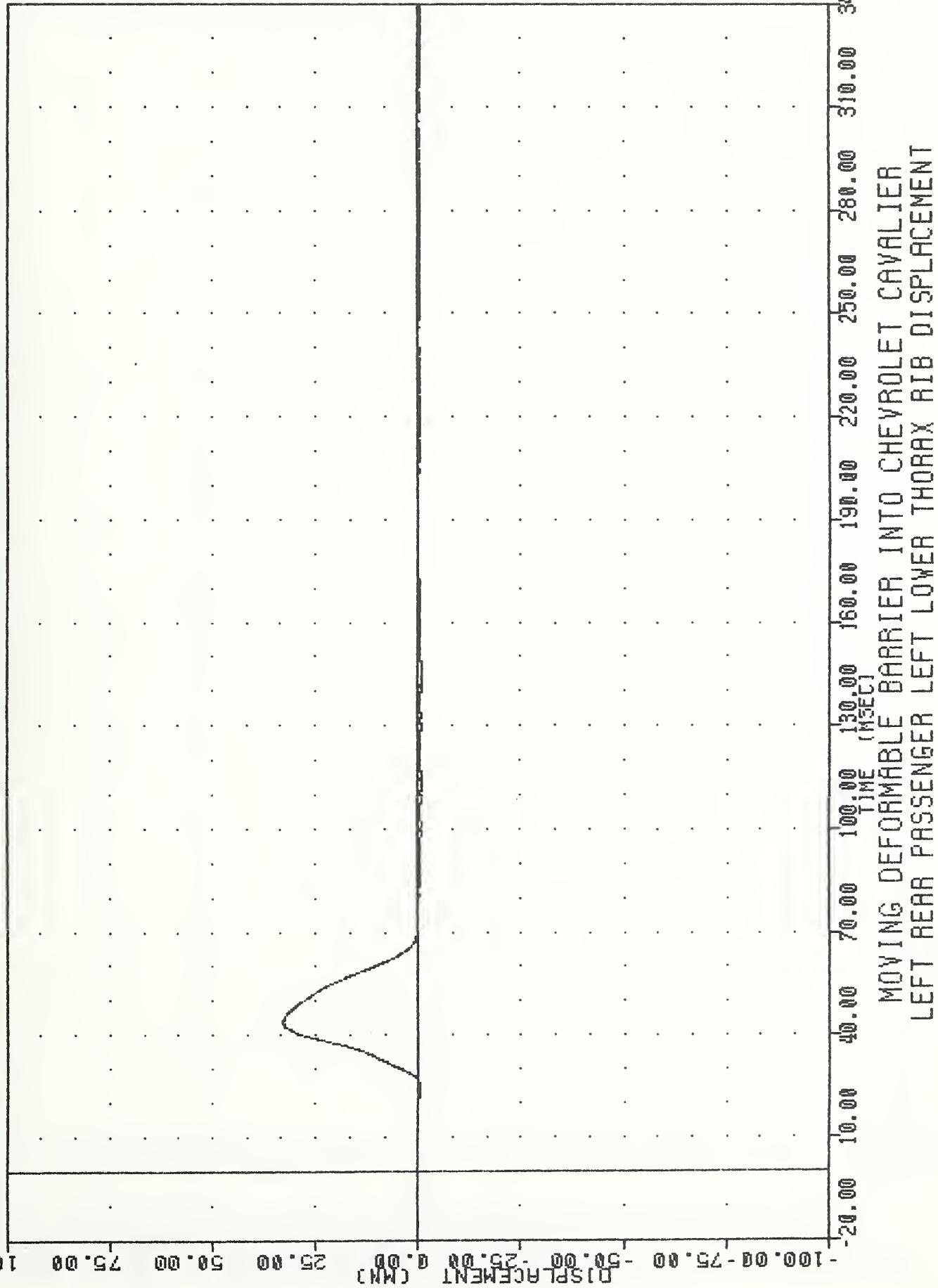
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
TIME (MSEC)
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT LOWER THORAX RIB Y-AXIS REDUNDANT ACCELERATION

VRTC , 900604
SI PROTECTION PROD VEHICLE
90154
LLRY40



VRTC 900604
SI PROTECTION PROD VEHICLE
90154 LLRYD4

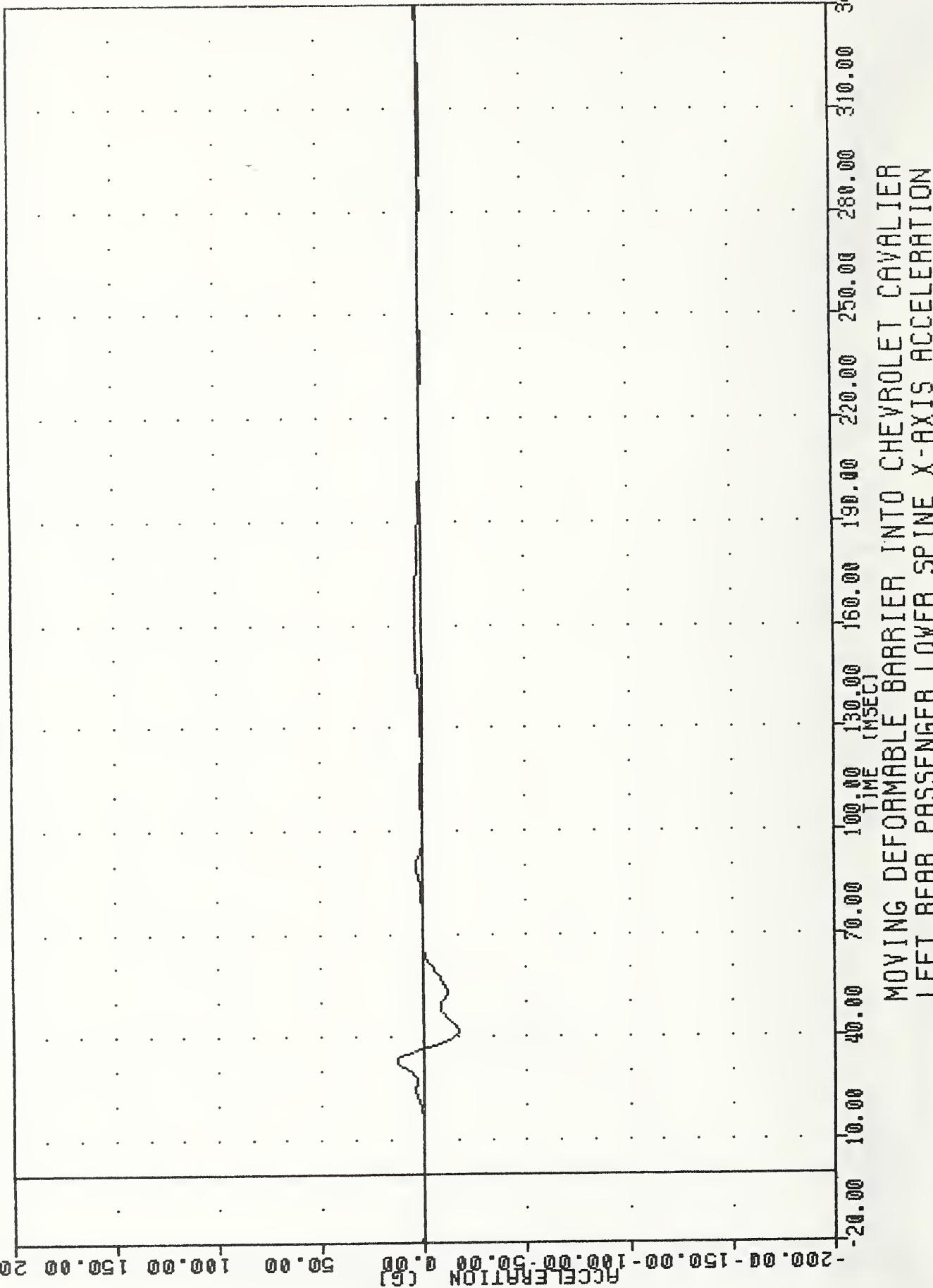
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.798 143.63
32.83 & 44.00



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT LOWER THORAX RIB DISPLACEMENT

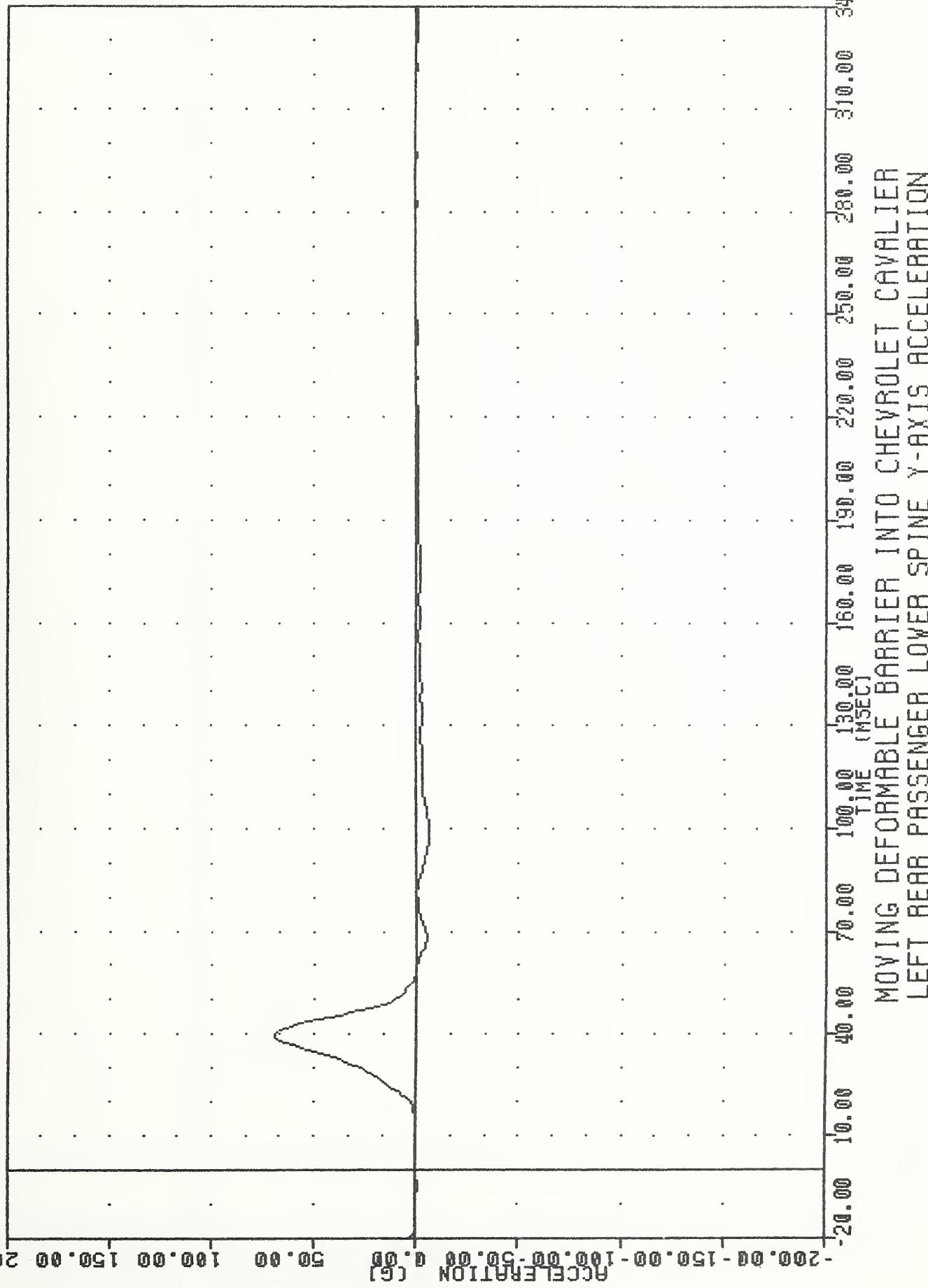
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
112X64

FILTER = HSRI 136/ 139/ -50
MIN. MAX VALUES = -16.448 41.87 - 13.46 0 33.13



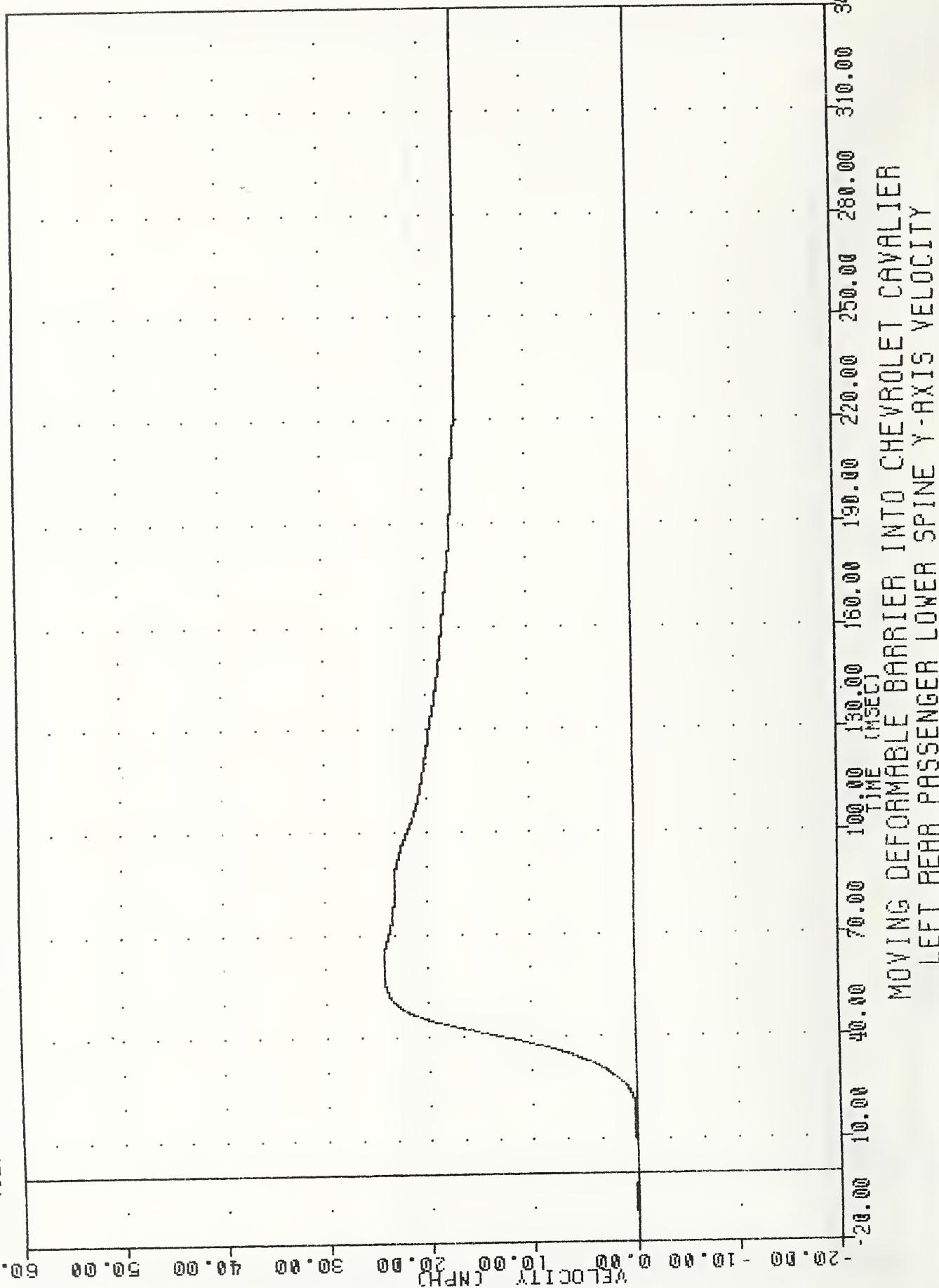
VRTC
SI PROTECTION PROD VEHICLE
90154
112Y64

FILTER = HSRII 136/ 189/ -50
MIN. MAX VALUES = -5.968 96.88 , 69.14 & 39.36



VRTC 900604
SI PROTECTION PROD VEHICLE
9@154
112Y4

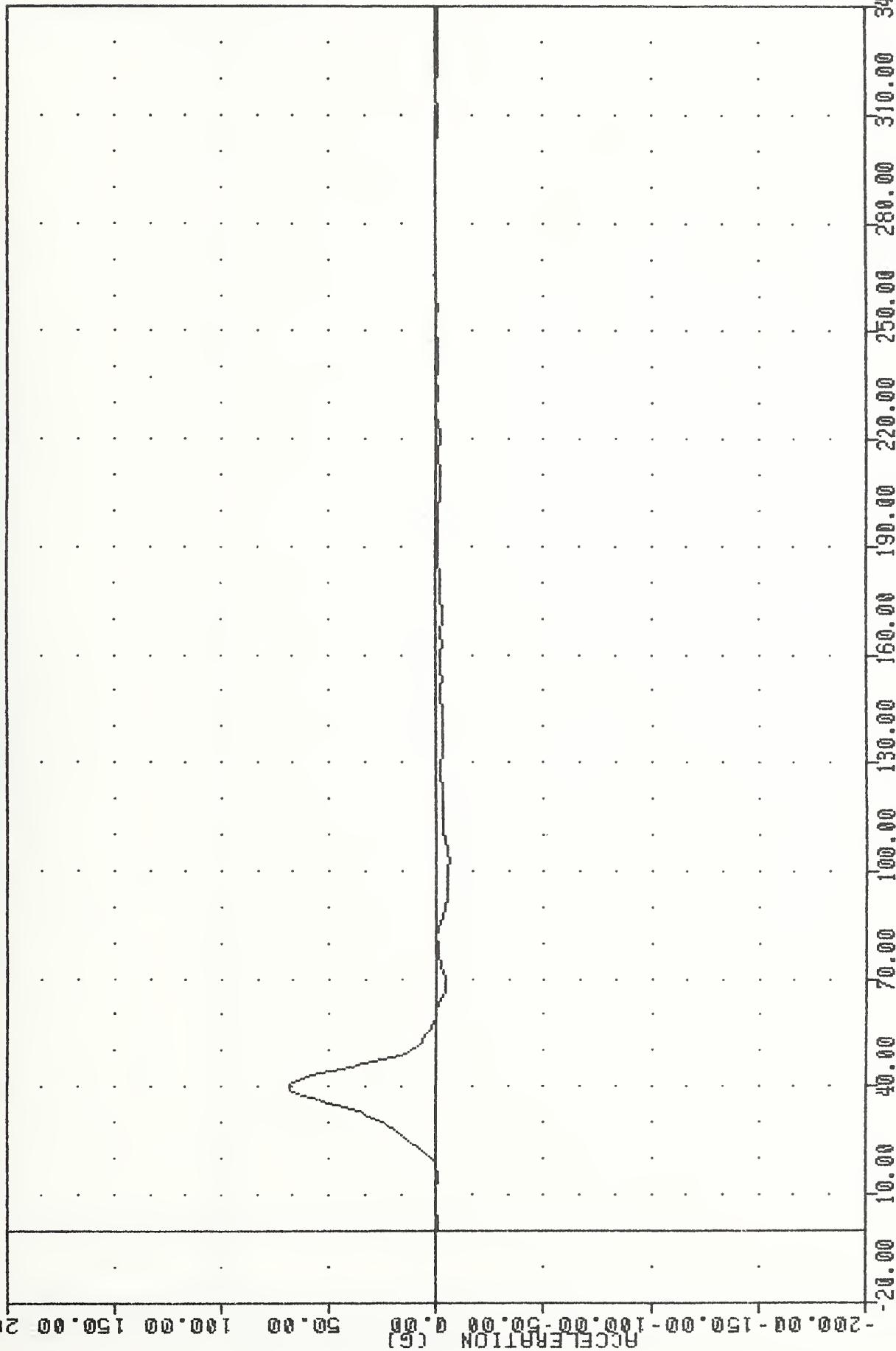
FILTER = BLPF 300/ 949/ -40
MIN. MAX VALUES = -0.028 -14.00 , 24.35 & 59.00



VRTC 900604
SI PROTECTION PROD VEHICLE
90154
112Y60

FILTER = HSRL 136/
MIN, MAX VALUES = -5.718 102.50 .

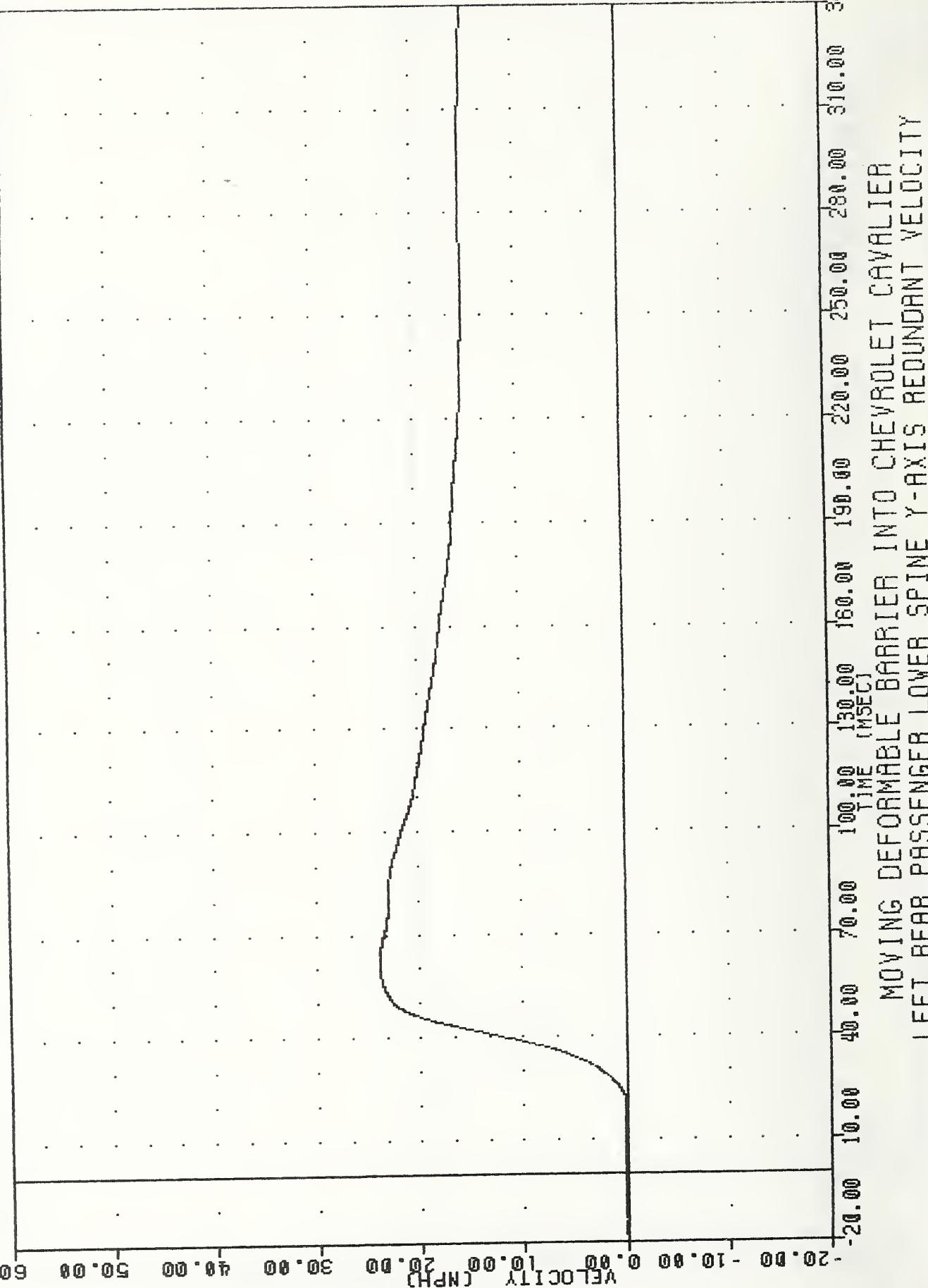
68.49 @ 40.00



Moving deformable barrier into Chevrolet Cavalier
Left rear passenger lower spine Y-axis redundant acceleration

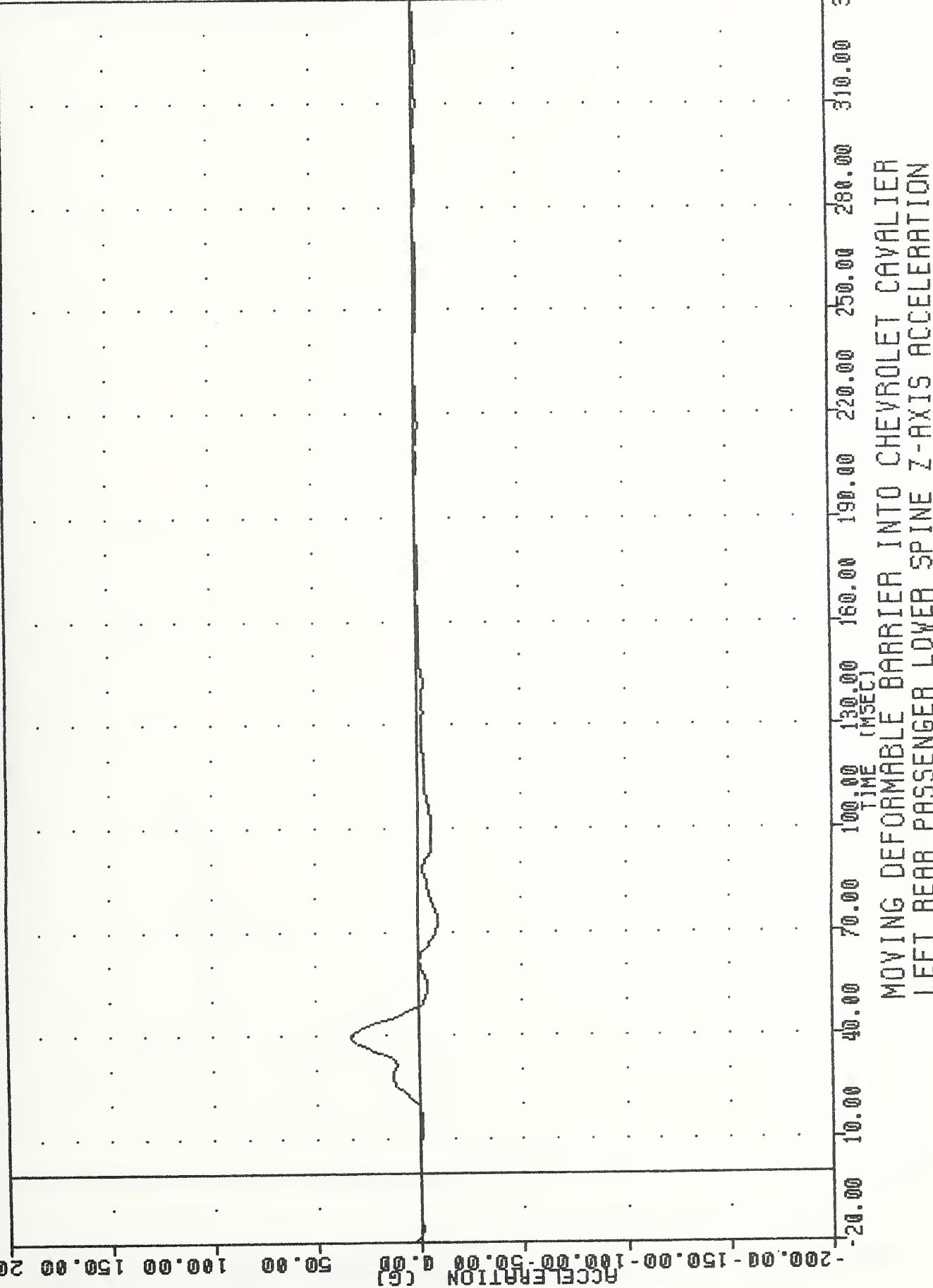
YRTC , 900904
SI PROTECTION PHOD VEHICLE
90154 112Y00

FILTER = BLPF 300/ 949/-40
MIN, MAX VALUES = 0.000 0.00 -20.00 , 23.90 & 63.50



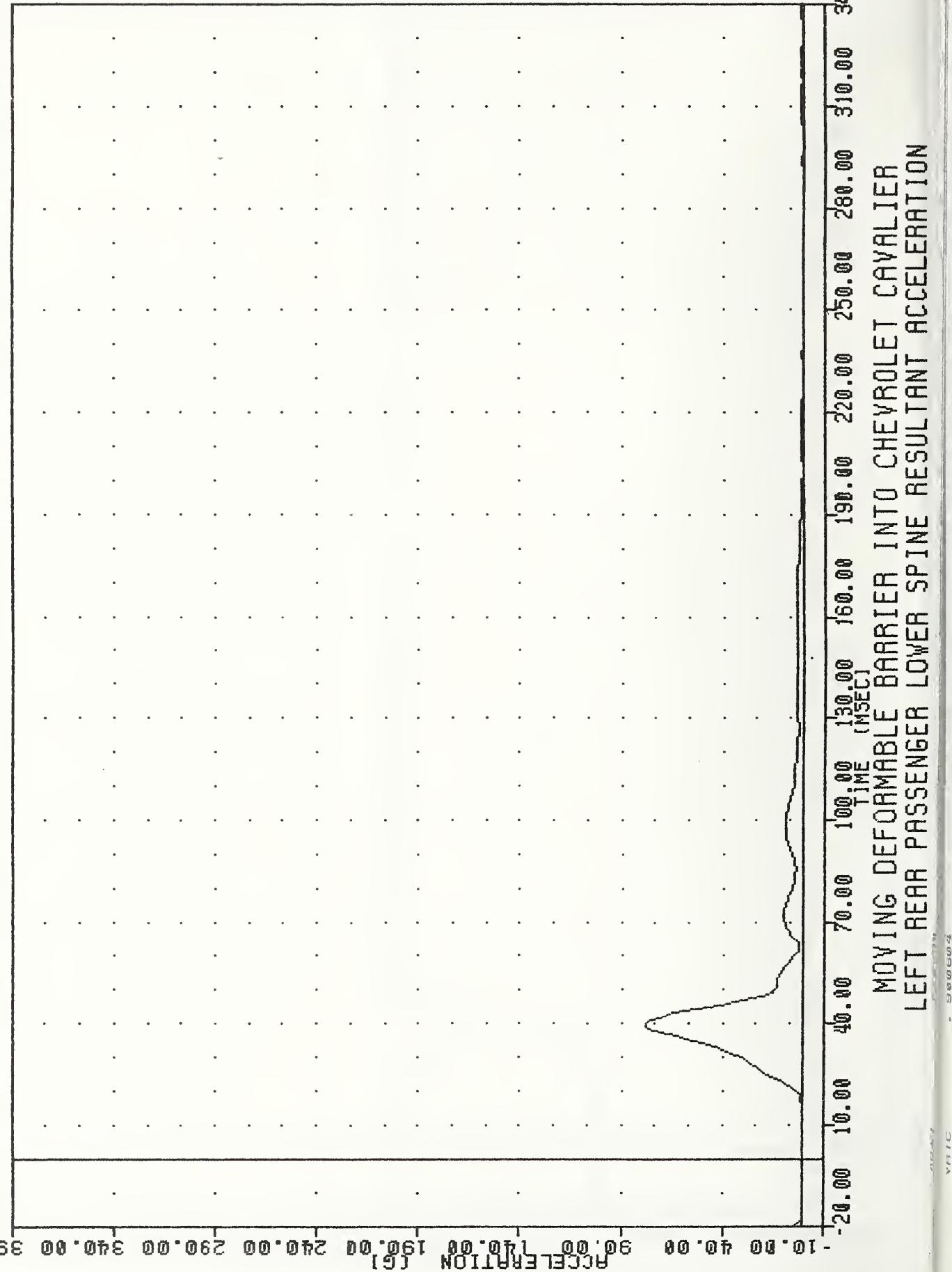
YRTC 900604
SI PROTECTION PROD VEHICLE
90154
112764

MIN, MAX VALUES = -9.488 73.13 • 32.69 @ 39.38
FILTER = HSRI 136/ 189/ -50



VRTC 900604
SI PROTECTION PROD VEHICLE
90154
112R64

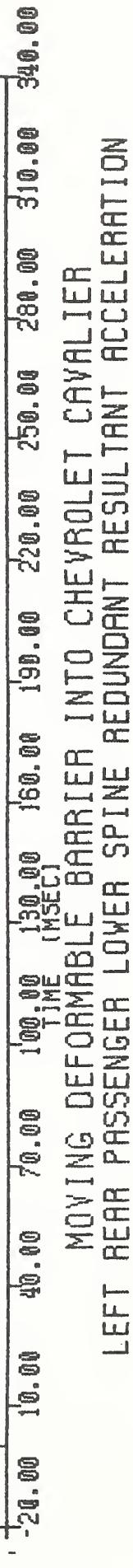
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.138 -15.00 -77.70 e 40.00



YRTC
SI PROTECTION PROD VEHICLE
90154
T12RG0

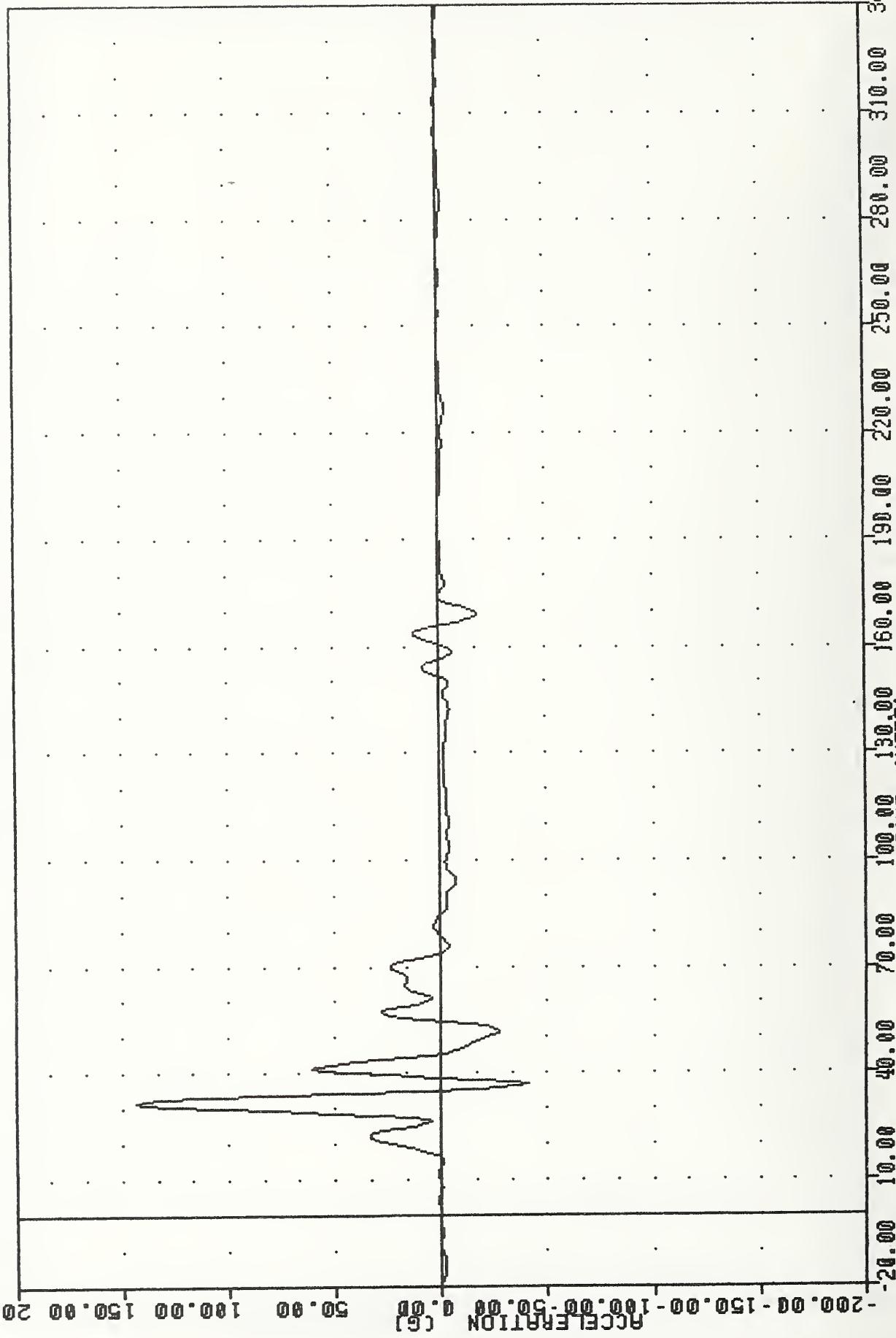
MIN. MAX VALUES = 0.088 272.50 .
FILTER = HSRI 136/ 189/ -50

MIN. MAX VALUES = 40.00 .



VRTC
SI PROTECTION PROD VEHICLE
90154
LURAY64

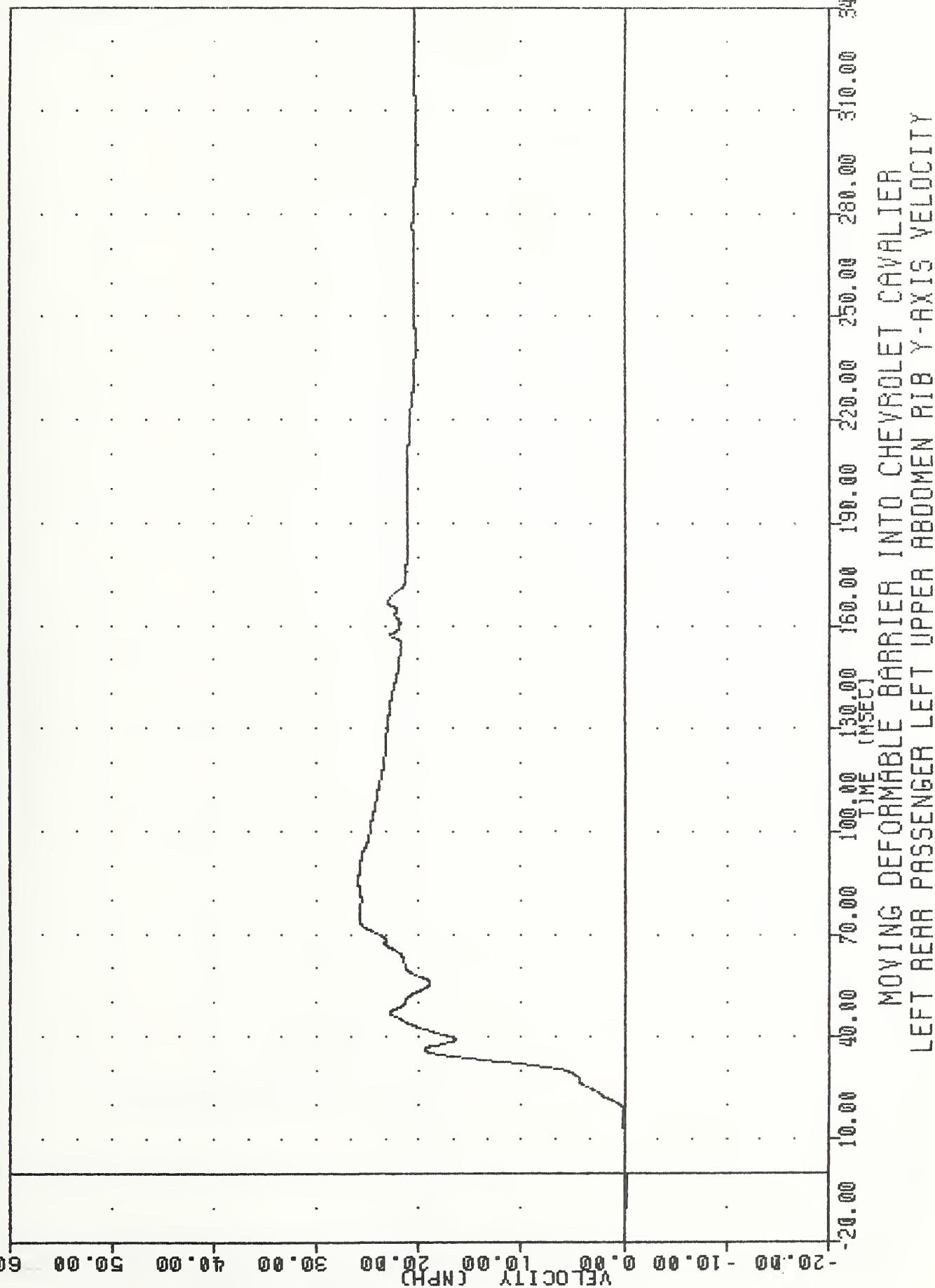
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -41.138 36.88 , 143.34 @ 31.88



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT UPPER ABDOMEN RIB Y-AXIS ACCELERATION

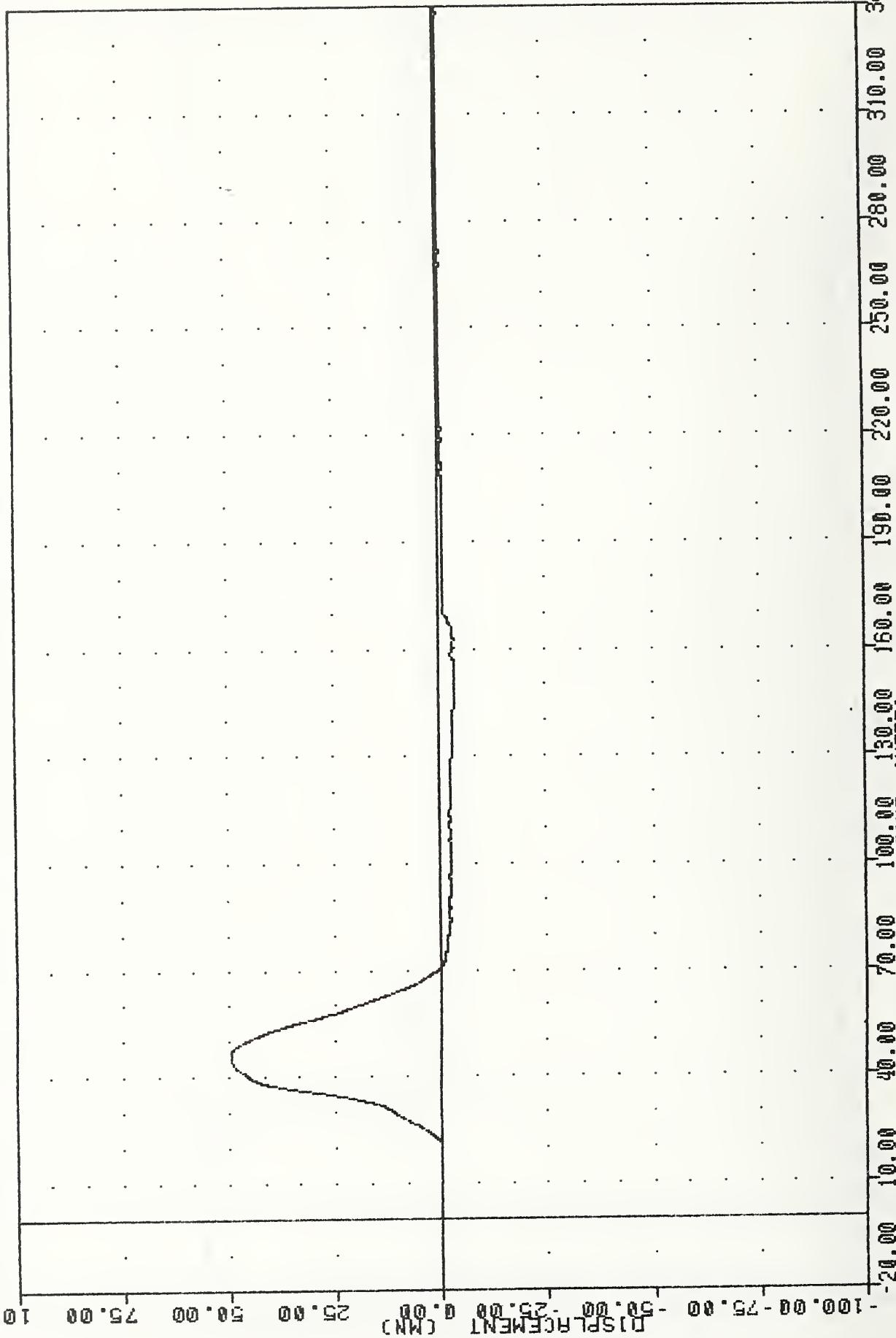
YRTC '900604
SI PROTECTION PROD VEHICLE
90154 LURV44
00.00 60.00

FILTER = BLPF 300/
MIN. MAX VALUES = -0.228 -7.88
26.00 86.00



VRIC
SI PROTECTION PRO VEHICLE
90154
LURD4

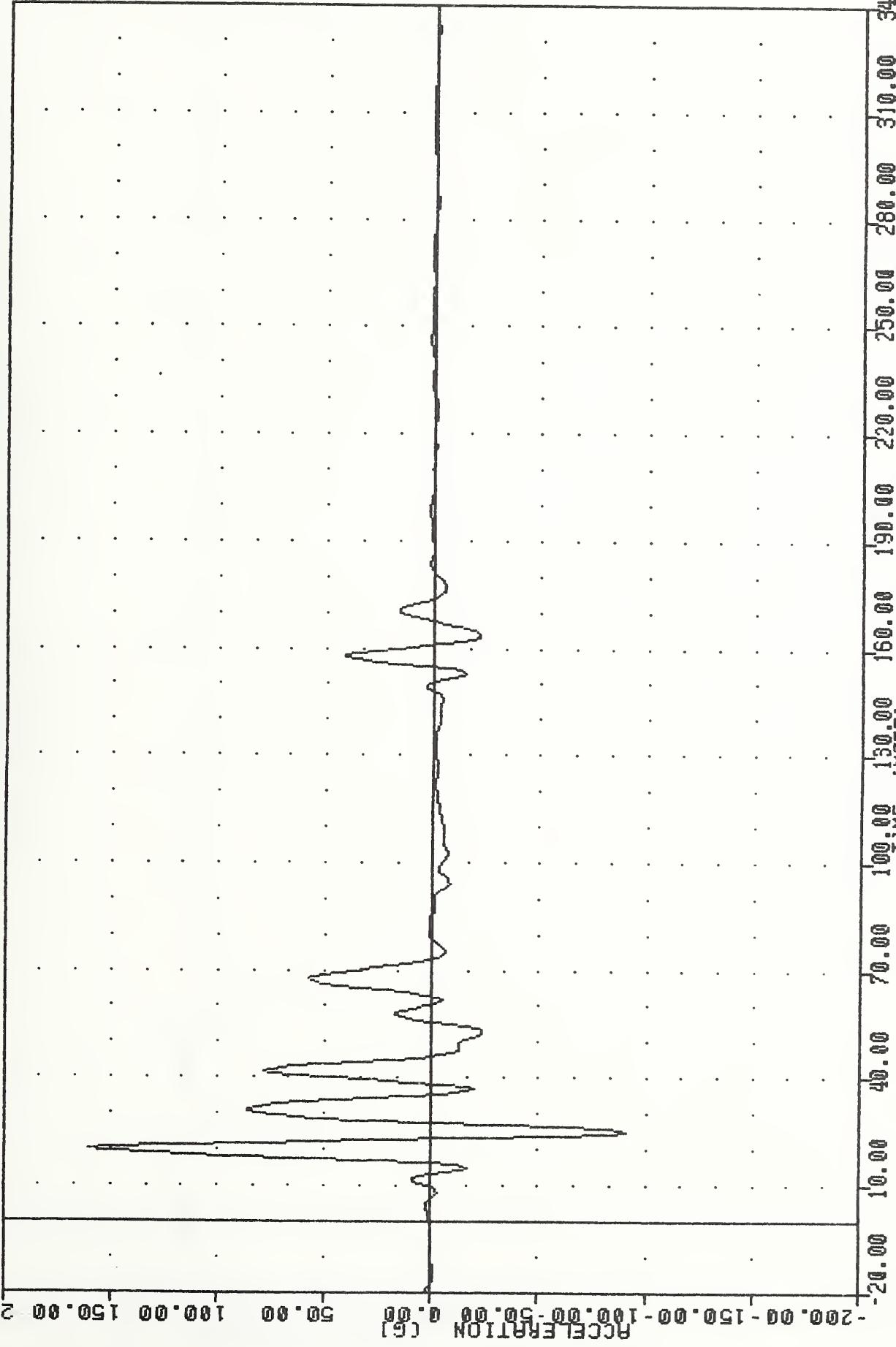
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -3.668 154.88 , 49.42 8 45.25



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT UPPER ABDOMEN RIB DISPLACEMENT

YRTC 900604
SI PROTECTION PROD VEHICLE
90154
LLAY64

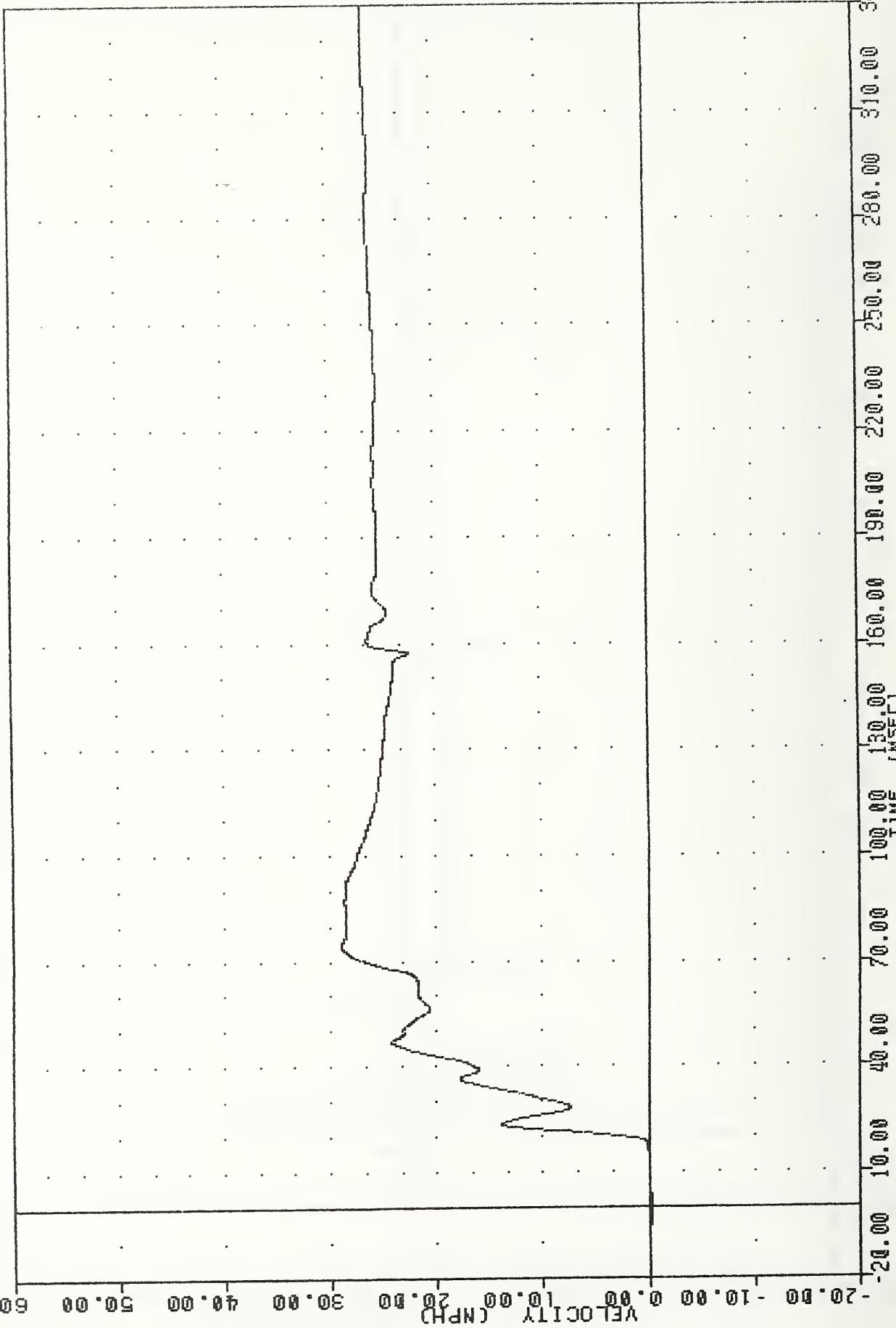
FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -91.068 25.00 , 160.55 & 20.00



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT LOWER ABDOMEN RIB Y-AXIS ACCELERATION

90154
SI PROTECTION PROD VEHICLE
LLAWY
YRTC , 900604

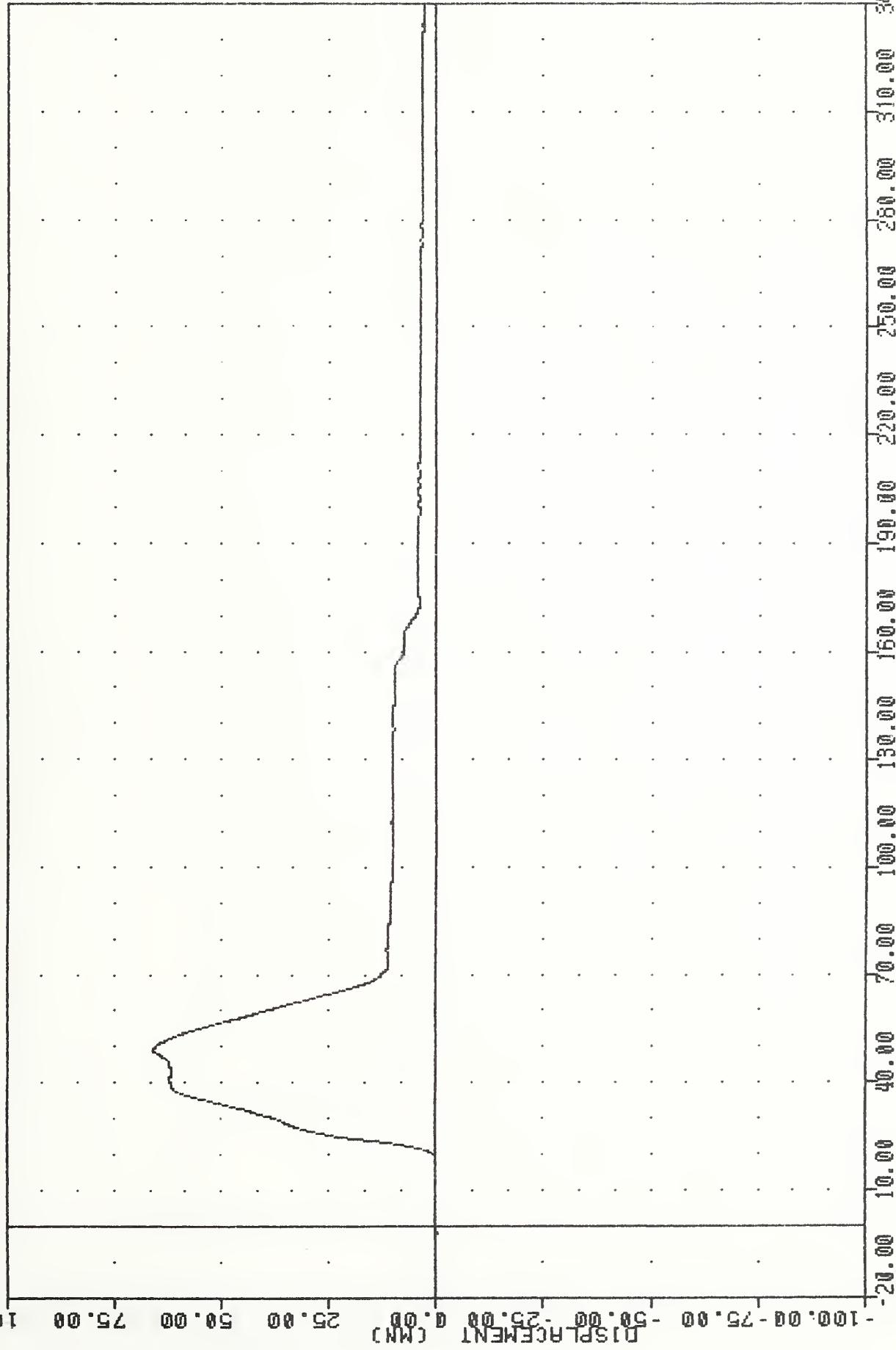
FILTER = BLPF 3000 / 949 / -40
MIN, MAX VALUES = -0.25 & -1.25 , 29.06 & 74.50



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT LOWER ABDOMEN RIB Y-AXIS VELOCITY

WATC
SI PROTECTION PROD VEHICLE
90154

MIN, MAX VALUES = 3000, 949/-40
FILTER = BLPF 3000, 0.15e -2.00
65.79 e 49.38

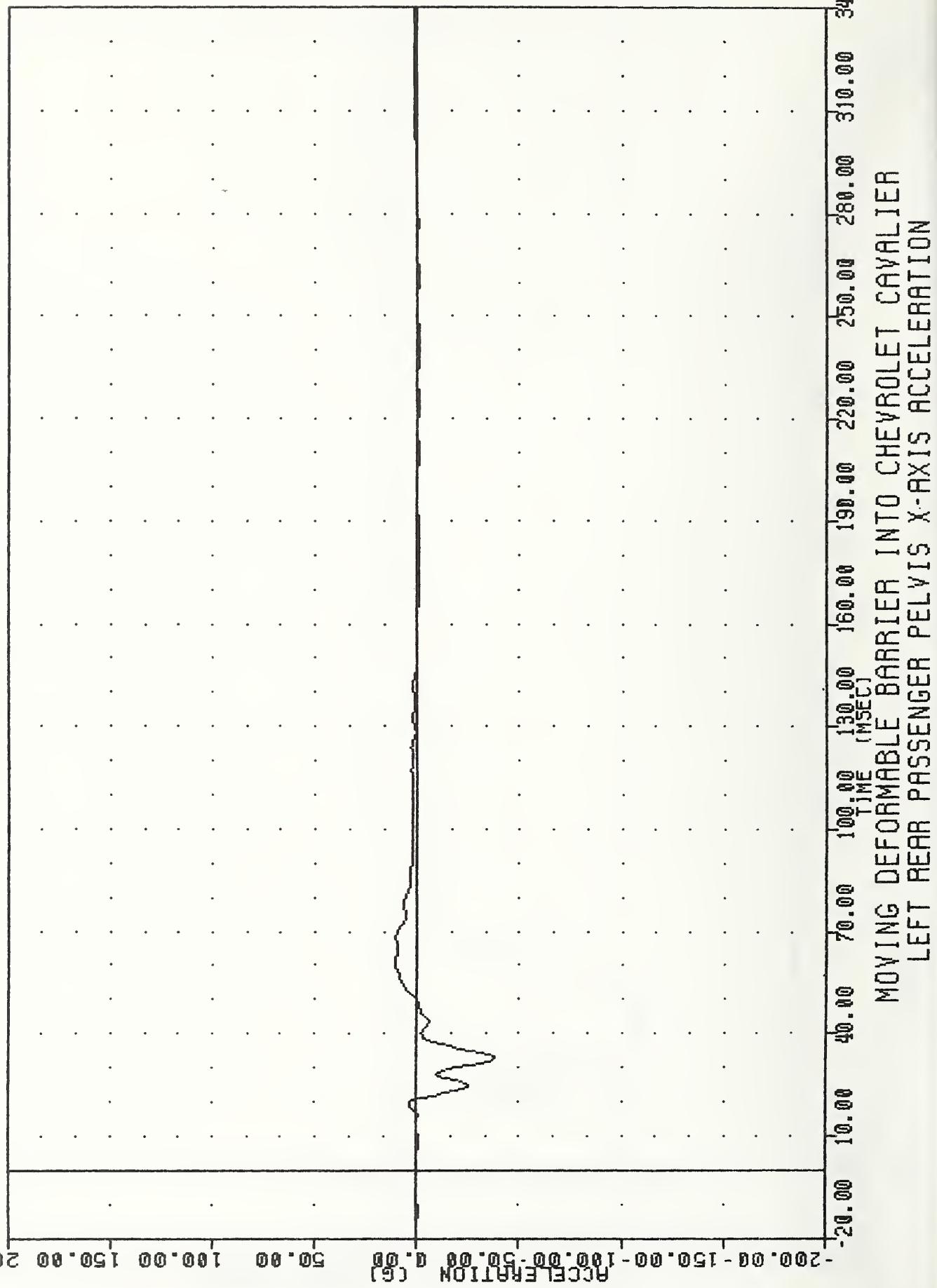


MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER LEFT LOWER ABDOMEN RIB DISPLACEMENT

YRTC 900604
SI PROTECTION PROD VEHICLE
90154 PEVX64

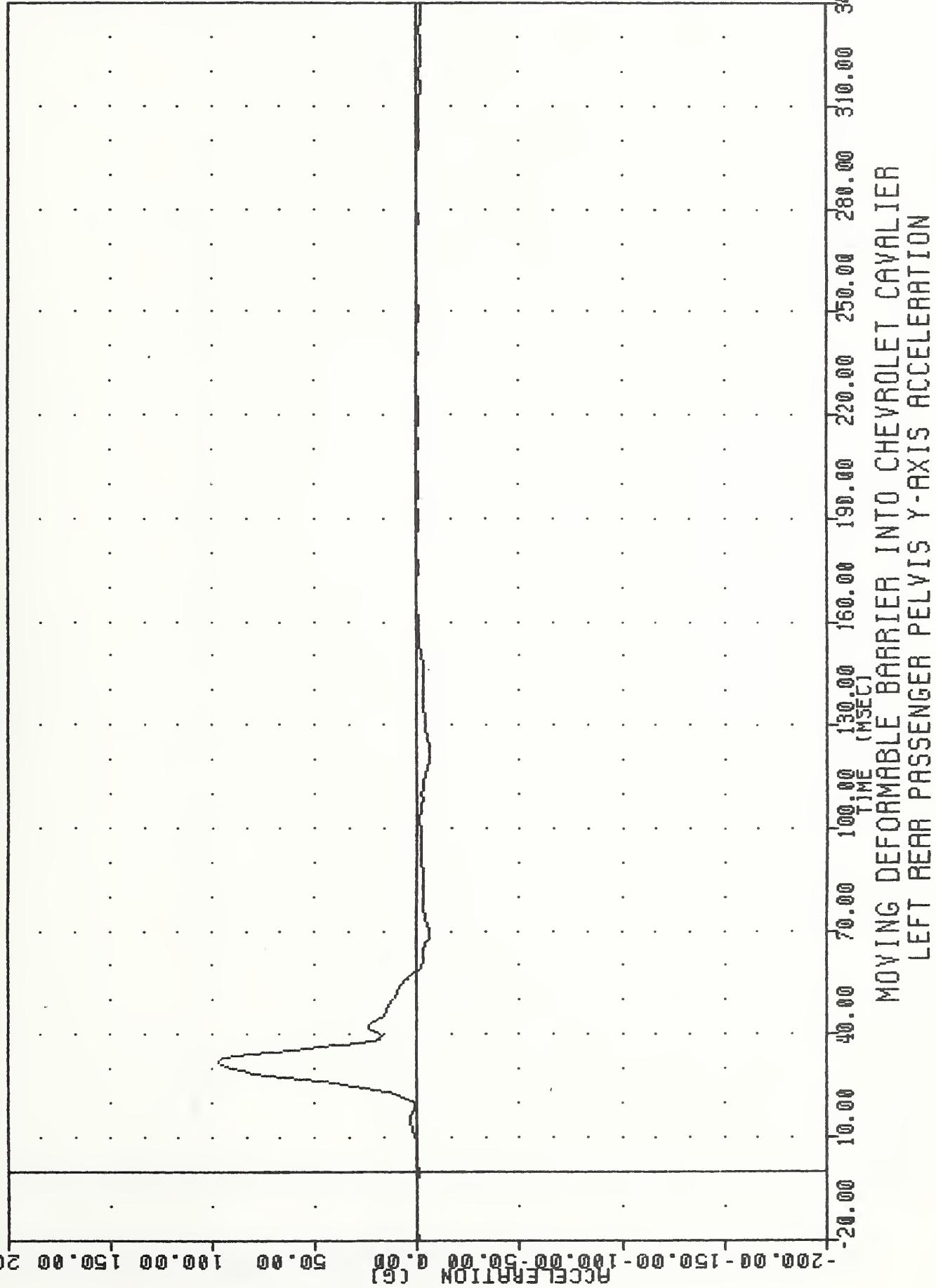
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -38.018 32.50 ,

10.87 0 61.25



VRTC 900604
SI PROTECTION PROD VEHICLE
90154
PEVY64

FILTER = HSRI
MIN, MAX VALUES = 136/ 189/ -50
-6.58@ 69.38 , 96.89 @ 31.88

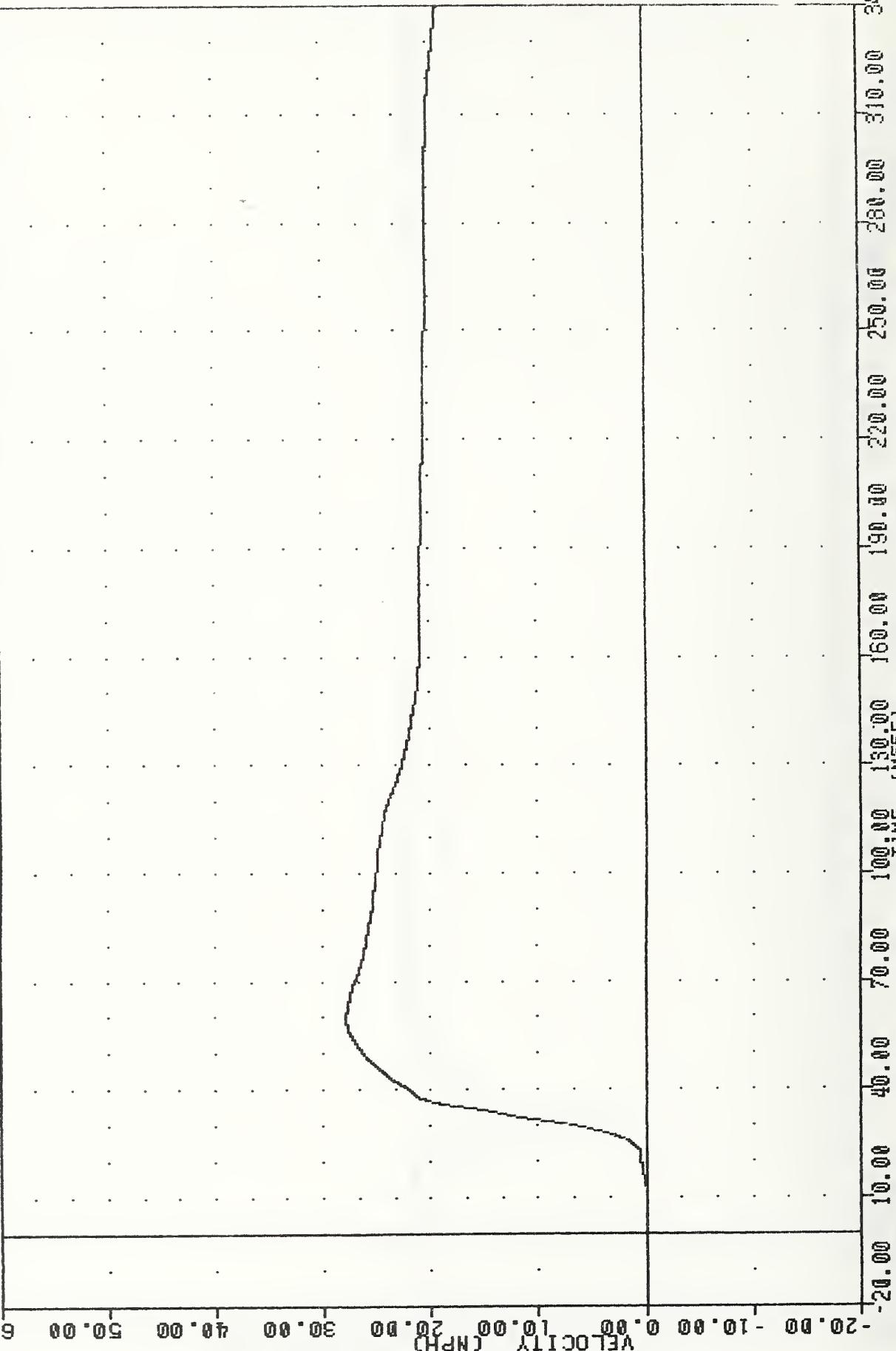


YRTC
SI PROTECTION PROD VEHICLE
90154
PEWMA

FILTER = BLPF 3000/ 949/-40
MIN, MAX VALUES = -0.000 5.63 , 27.86 & 59.75

PEWMA

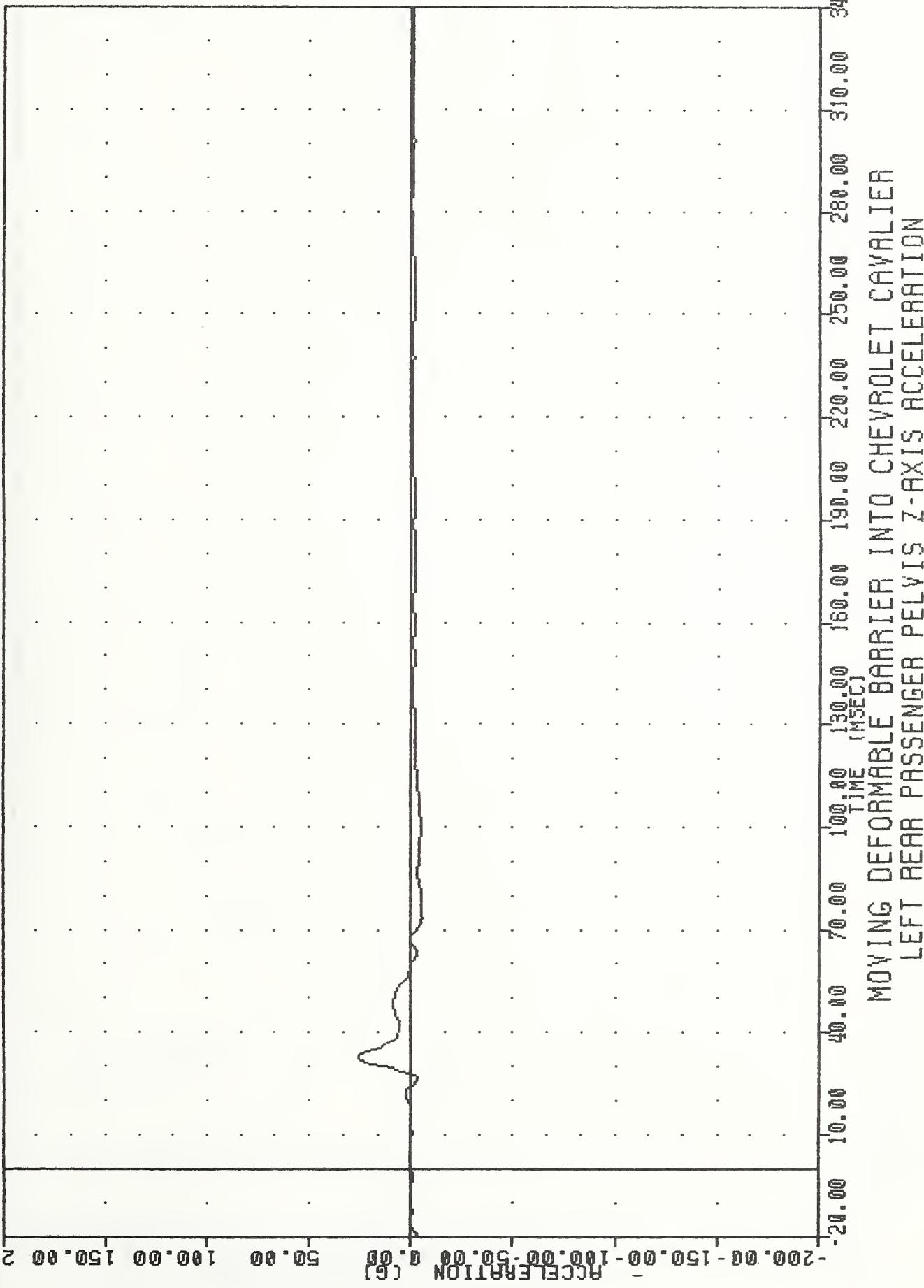
PEWMA



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
LEFT REAR PASSENGER PELVIS Y-AXIS VELOCITY

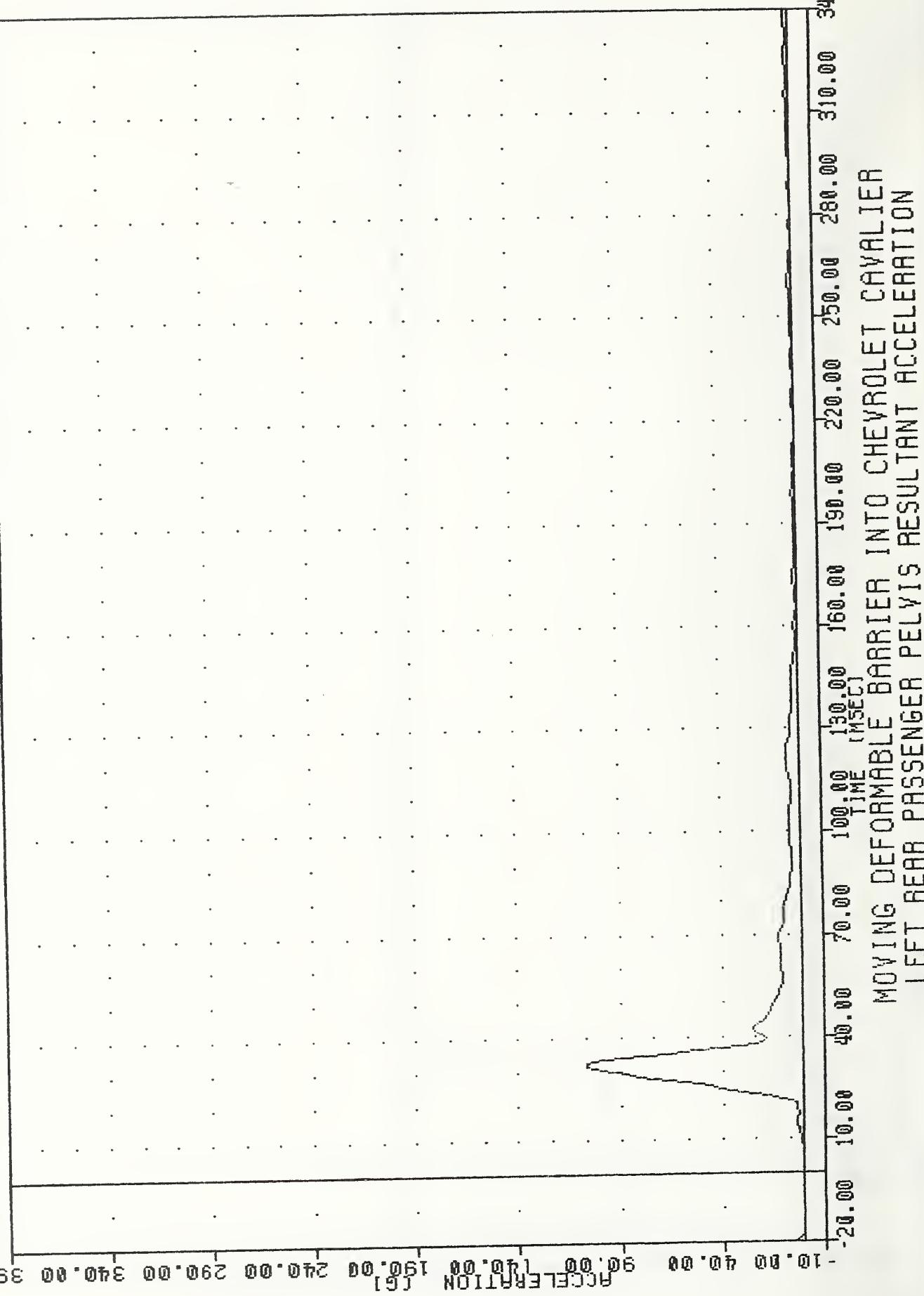
YRTC , 900604
SI PROTECTION PROD VEHICLE
90154
PEVZ64

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = -5.588 73.75 , 25.81 @ 32.50



YRTIC
SI PROTECTION PHOD VEHICLE
90154
PEWRG4

FILTER = HSRI 136/
MIN, MAX VALUES = 0.150 -15.00 , 106.54 & 32.50

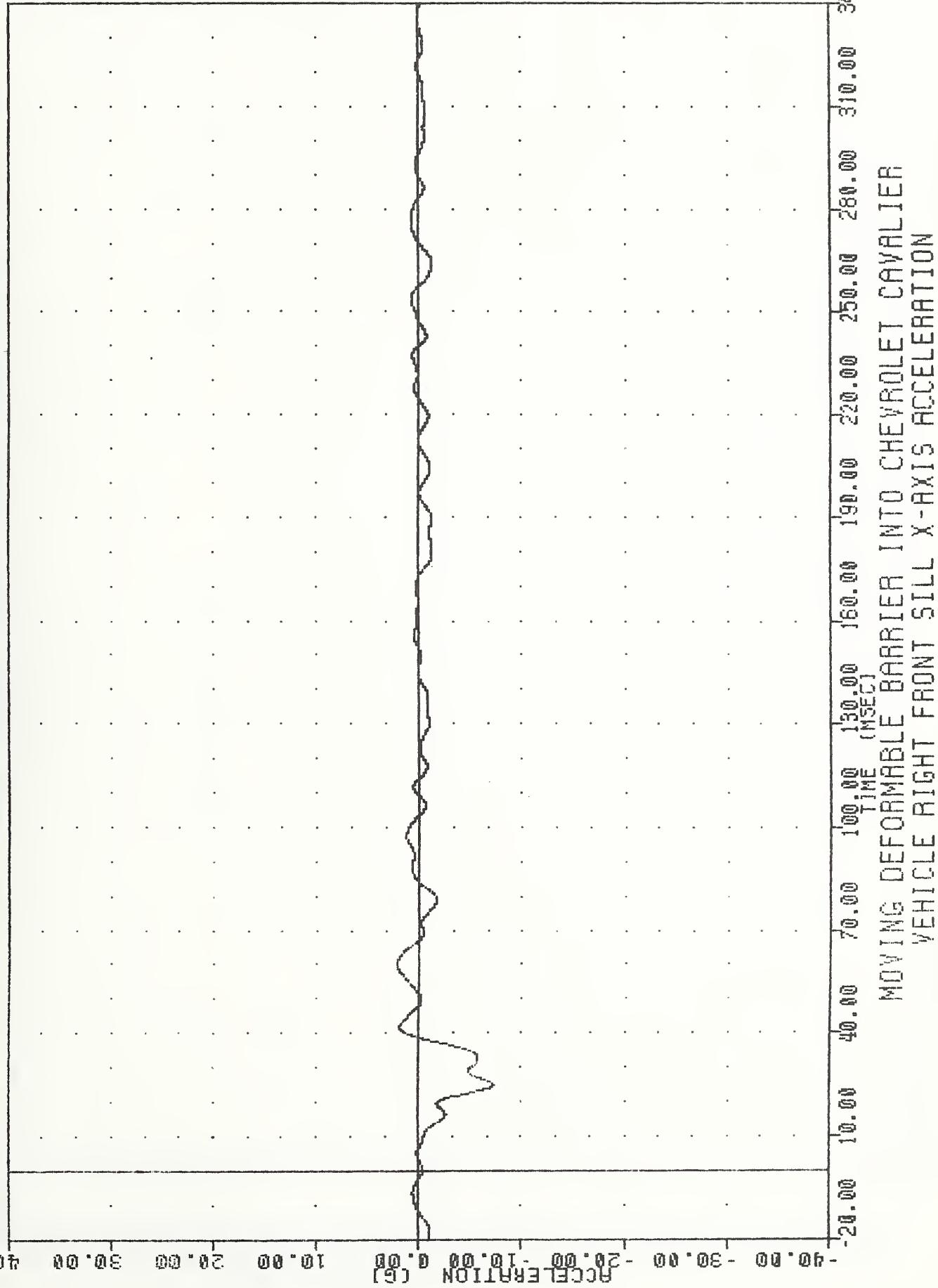


WTTC 950604
SI PROTECTION PROD VEHICLE
90154
RF SX6

MIN, MAX VALUES = -7.298 24.88 , 2.24 8 60.00

FILTER = BLPF 1000/ 316/ ~40

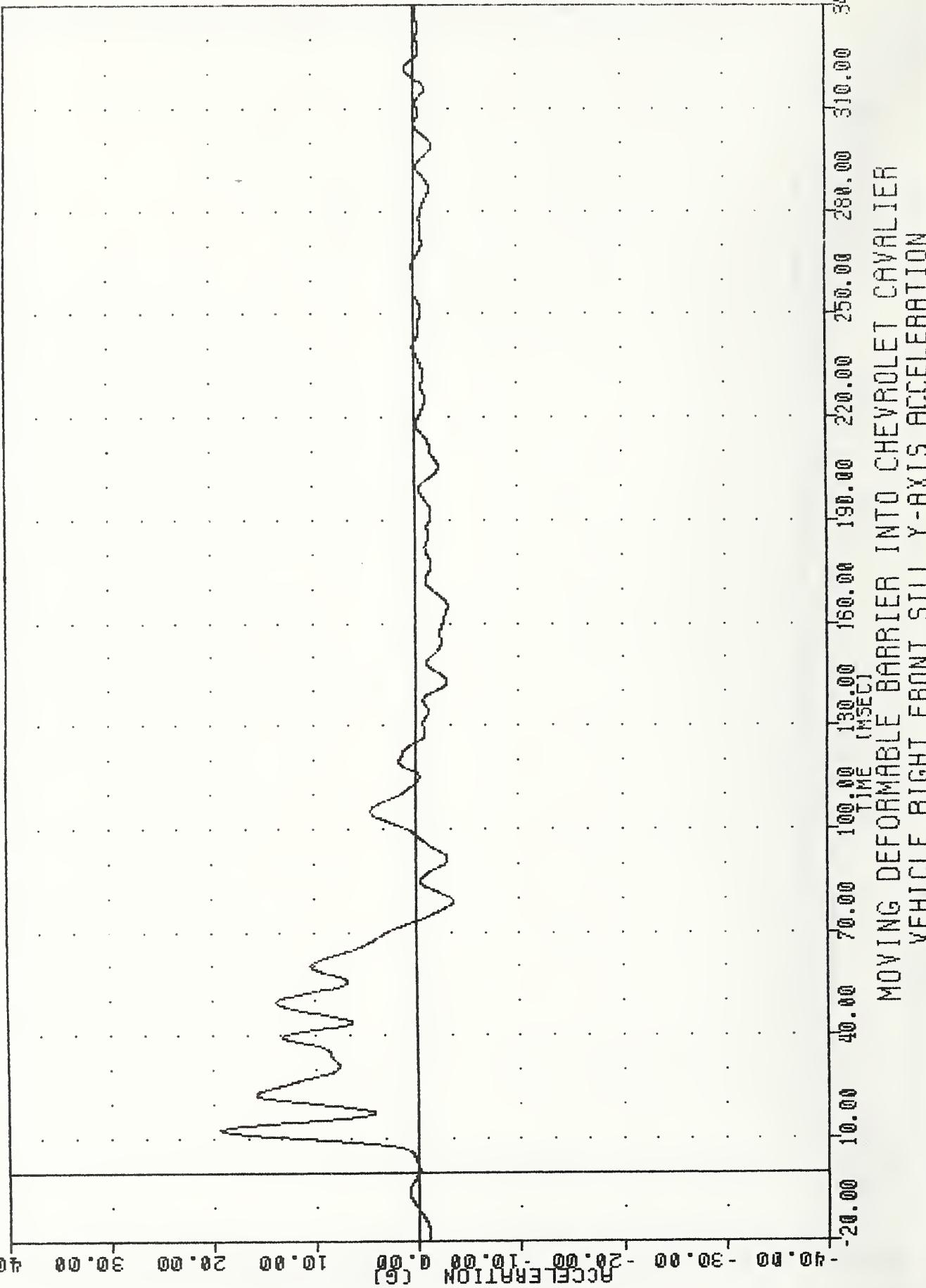
-40.00 -30.00 -20.00 -10.00 0.00 10.00 20.00 30.00 40.00 ACCELERATION (G)



MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
VEHICLE RIGHT FRONT SILL X-AXIS ACCELERATION

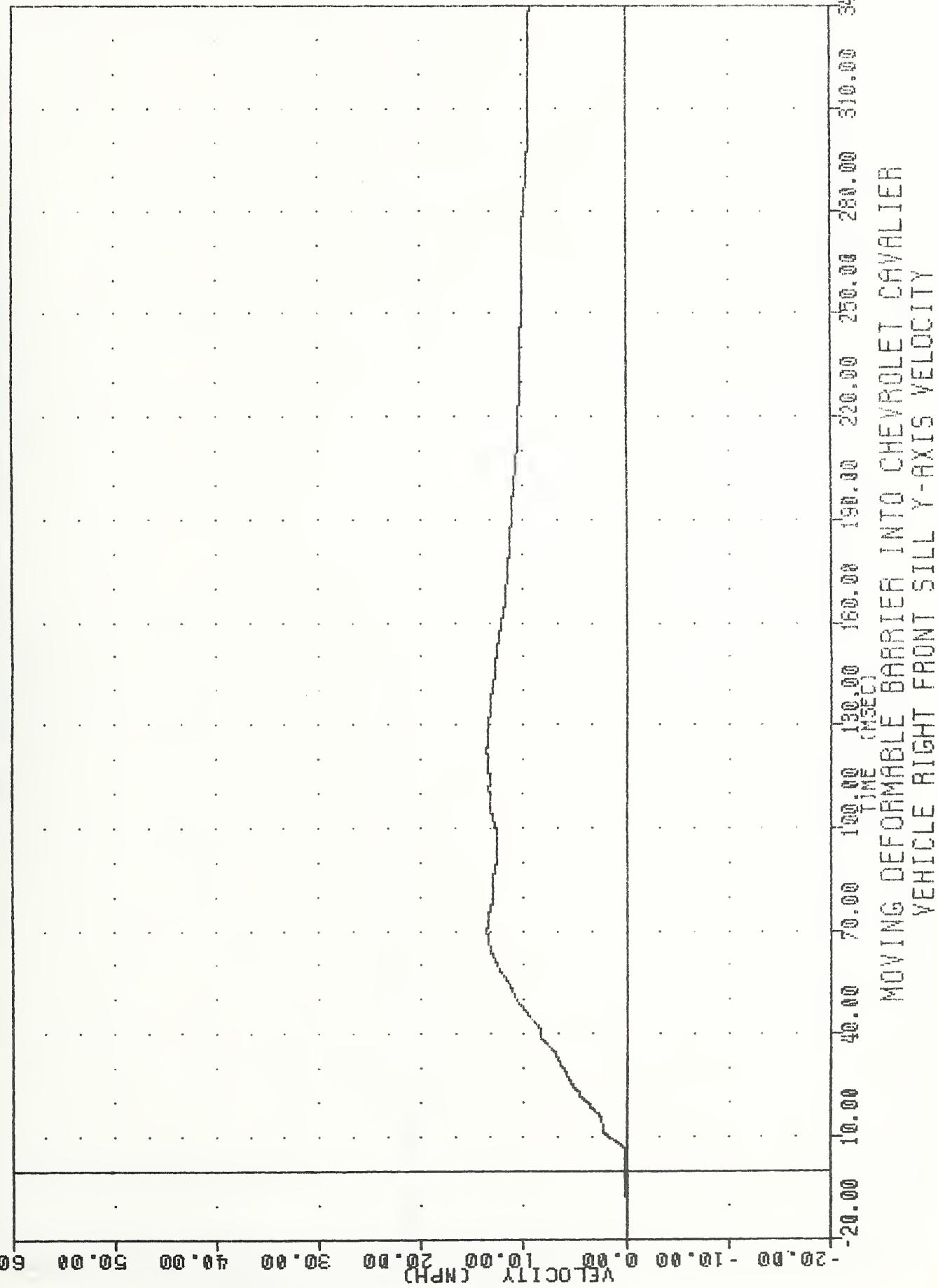
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
RFSY6

FILTER = BLPF 100/ 316/-40
MIN, MAX VALUES = -3.588 78.88 , 19.26 & 12.38



YRTC 900604
SI PROTECTION PROD VEHICLE
90154
RFSYV

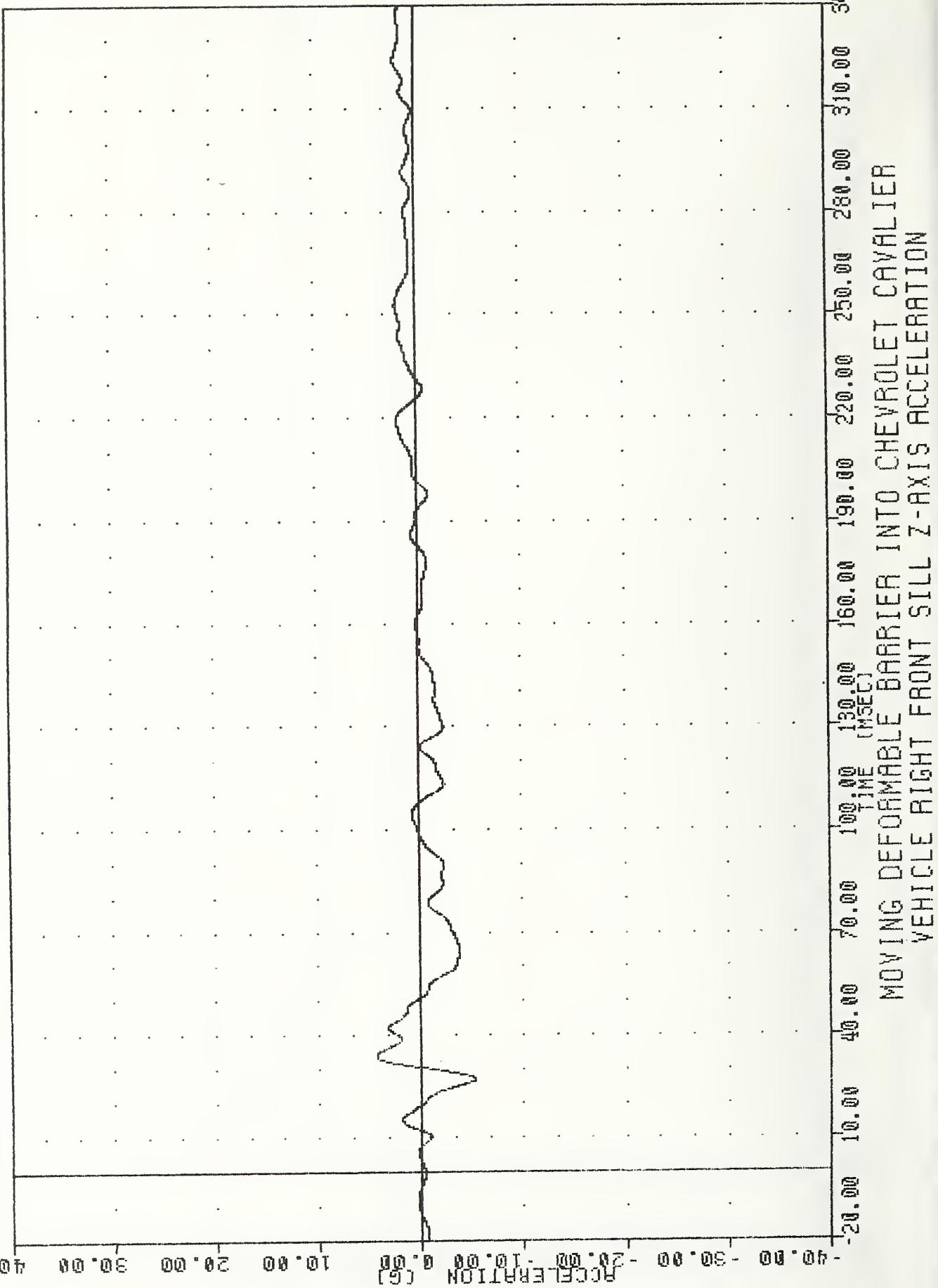
FILTER = BLFF 300/ 949/-40
MIN, MAX VALUES = -0.0088 -13.63 , 13.61 & 122.36



VRTC , 900804
SI PROTECTION PROD VEHICLE
90154
RFSZ6

FILTER = BLPF 100/ 316/-40
MIN. MAX VALUES = -5.288 27.00 ,

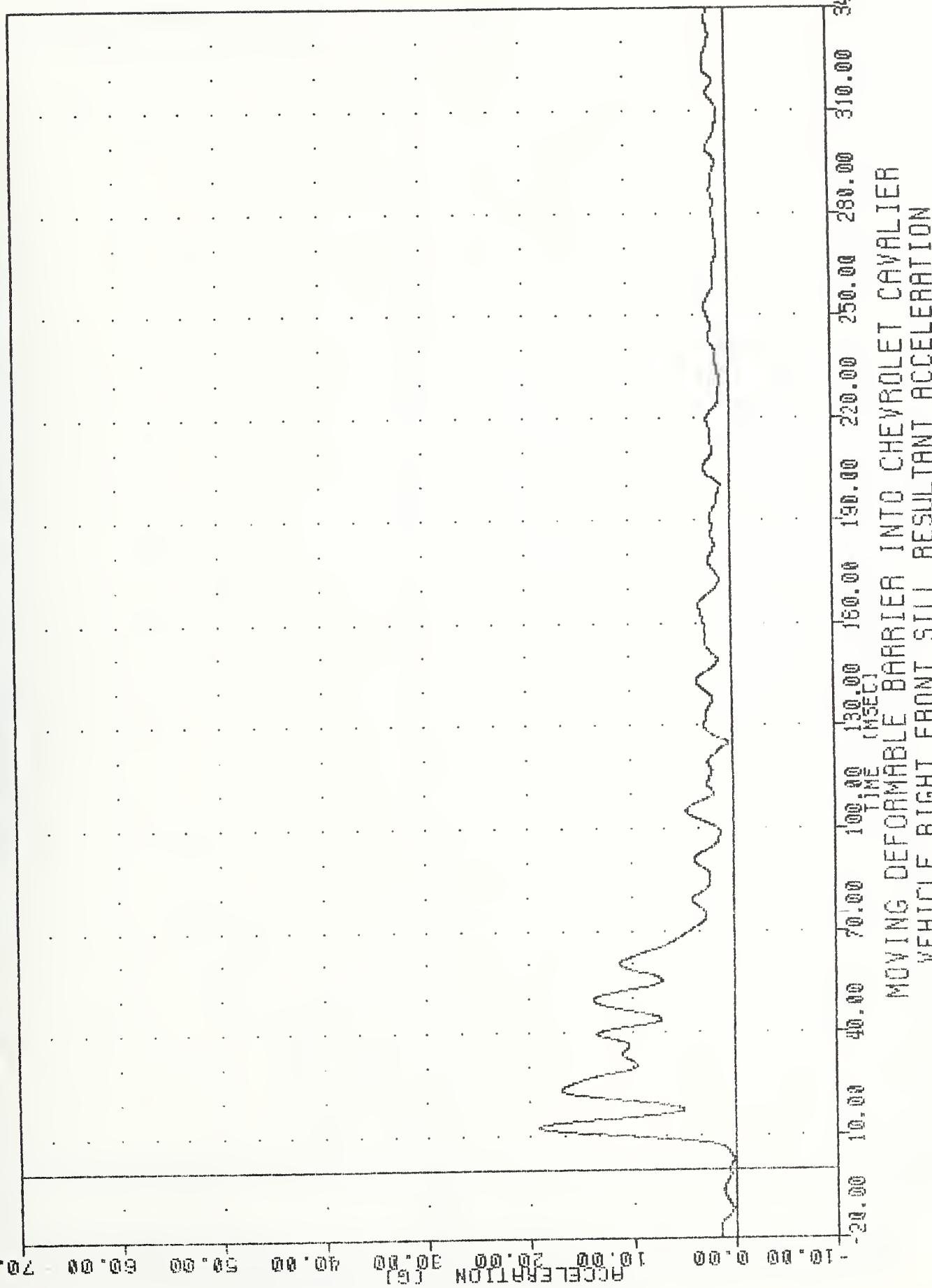
4.38 8 33.75



WTTC 900604
SI PROTECTION PROD VEHICLE
90154
AF SRG

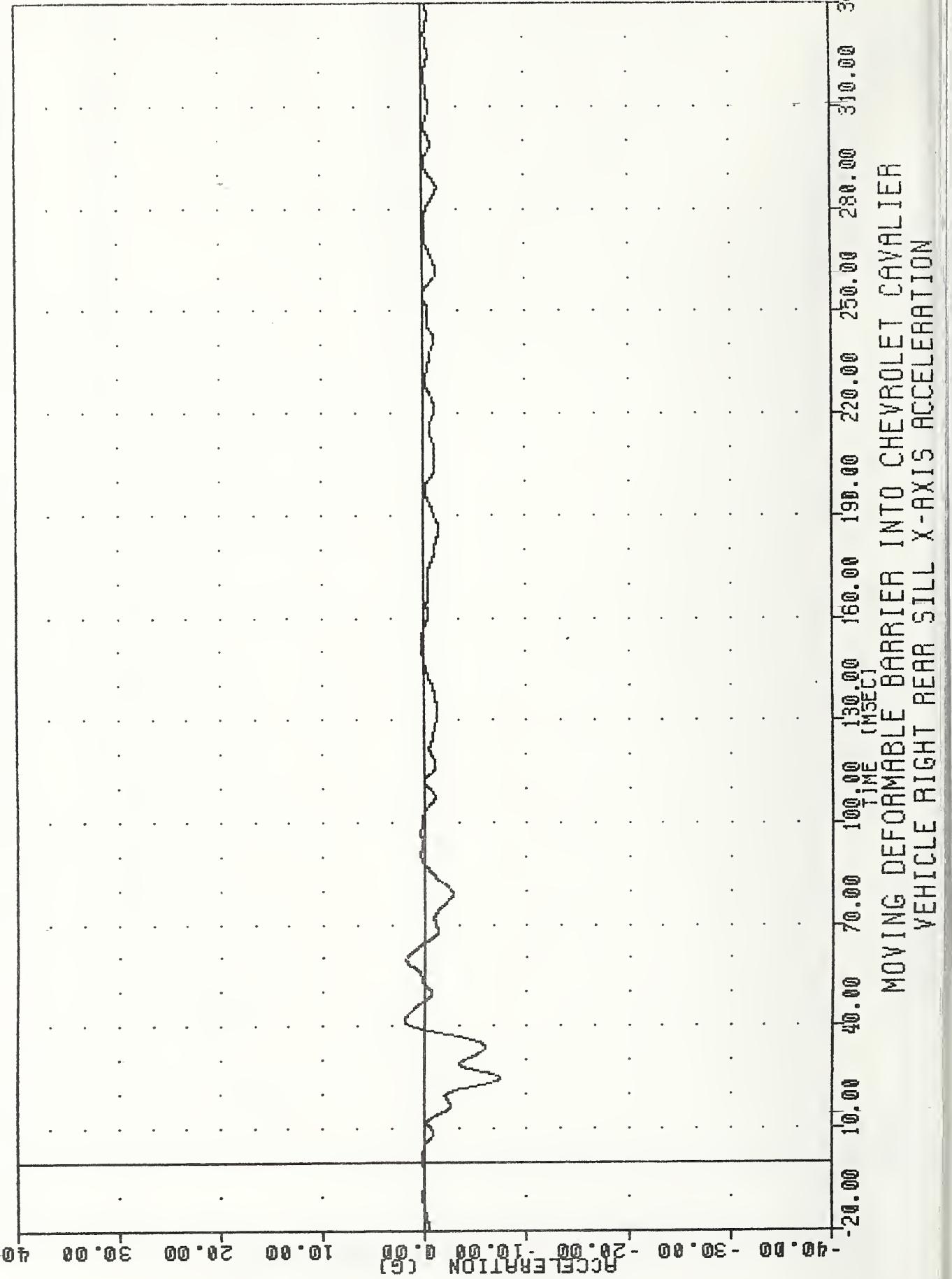
MIN, MAX VALUES = 0.170 2.88
FILTER = BLPF 100/ -40

19.29 8 12.38



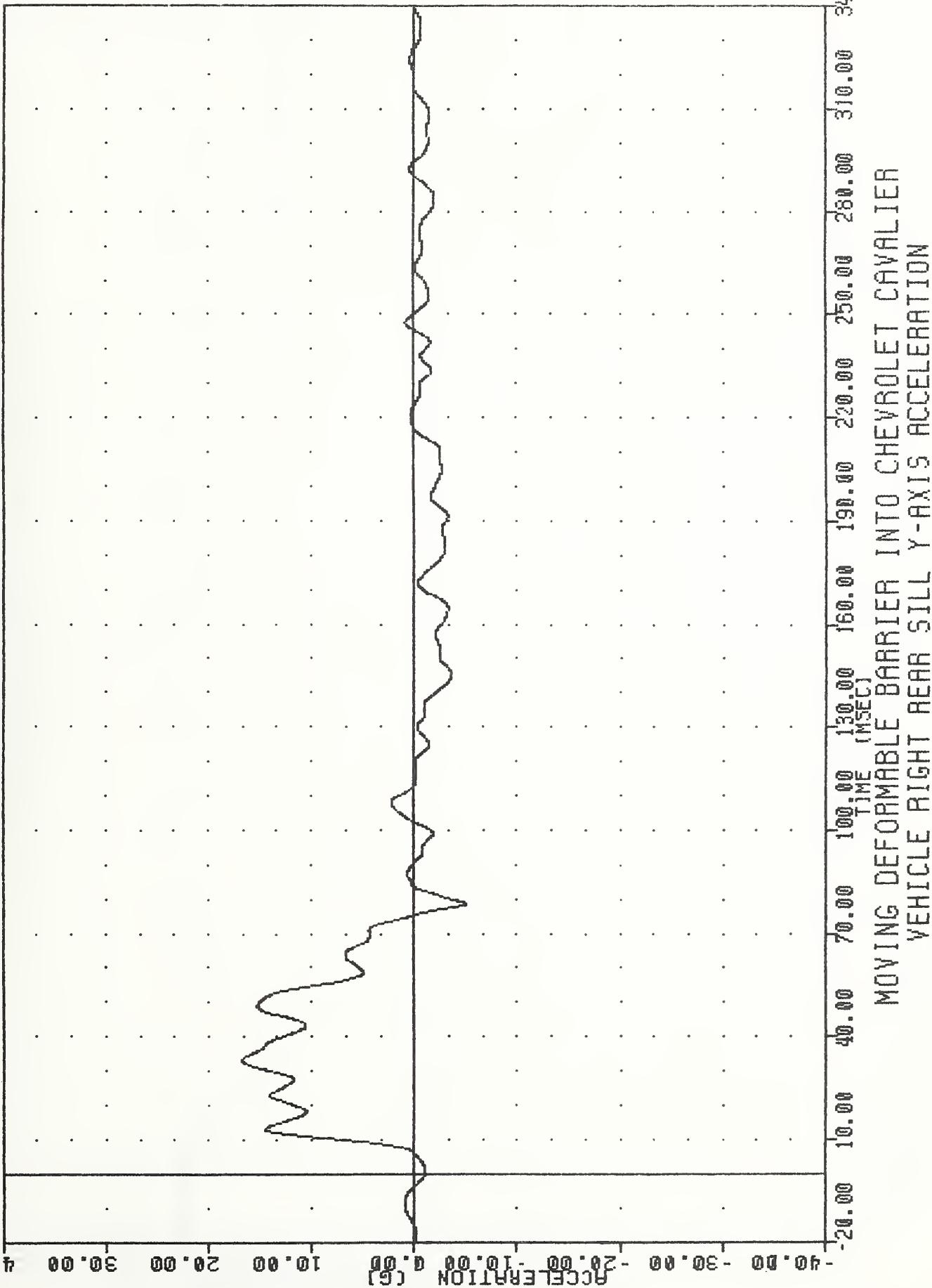
YATC 900604
SI PROTECTION PROD VEHICLE
90154
ARRSG

FILTER = BLPF 100/ 316/-40
MIN. MAX VALUES = -7.348 24.63 , 2.05 & 41.75



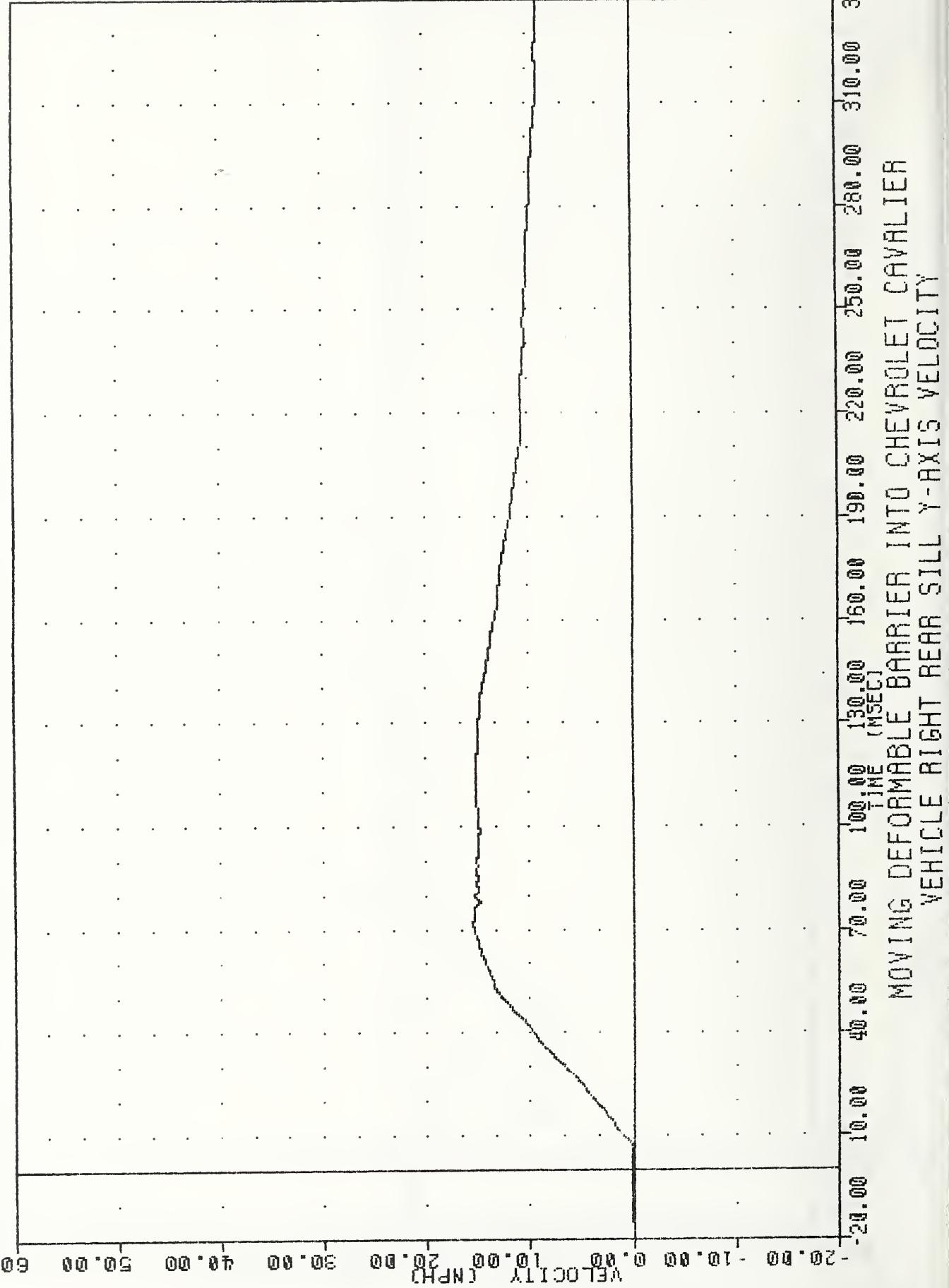
YRTC 900604
SI PROTECTION PROD VEHICLE
90154
ARSY6

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -5.078 78.63 . 16.79 @ 33.00



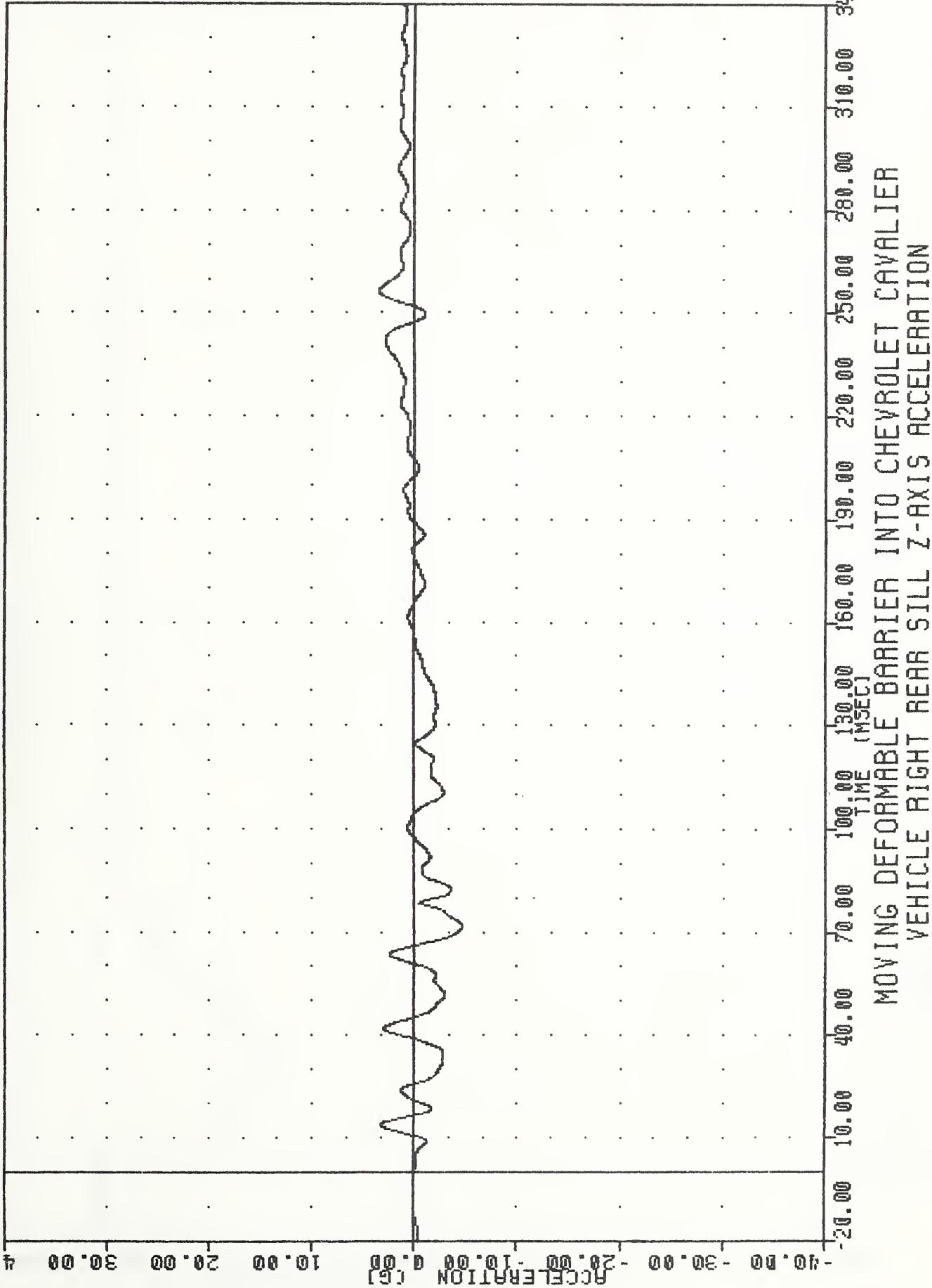
900604
SI PROTECTION PROD VEHICLE
90154
RSYY

FILTER = BLFF 300/ 949/ -40
MIN. MAX VALUES = -0.018 -16.75 , 15.53 & 71.63



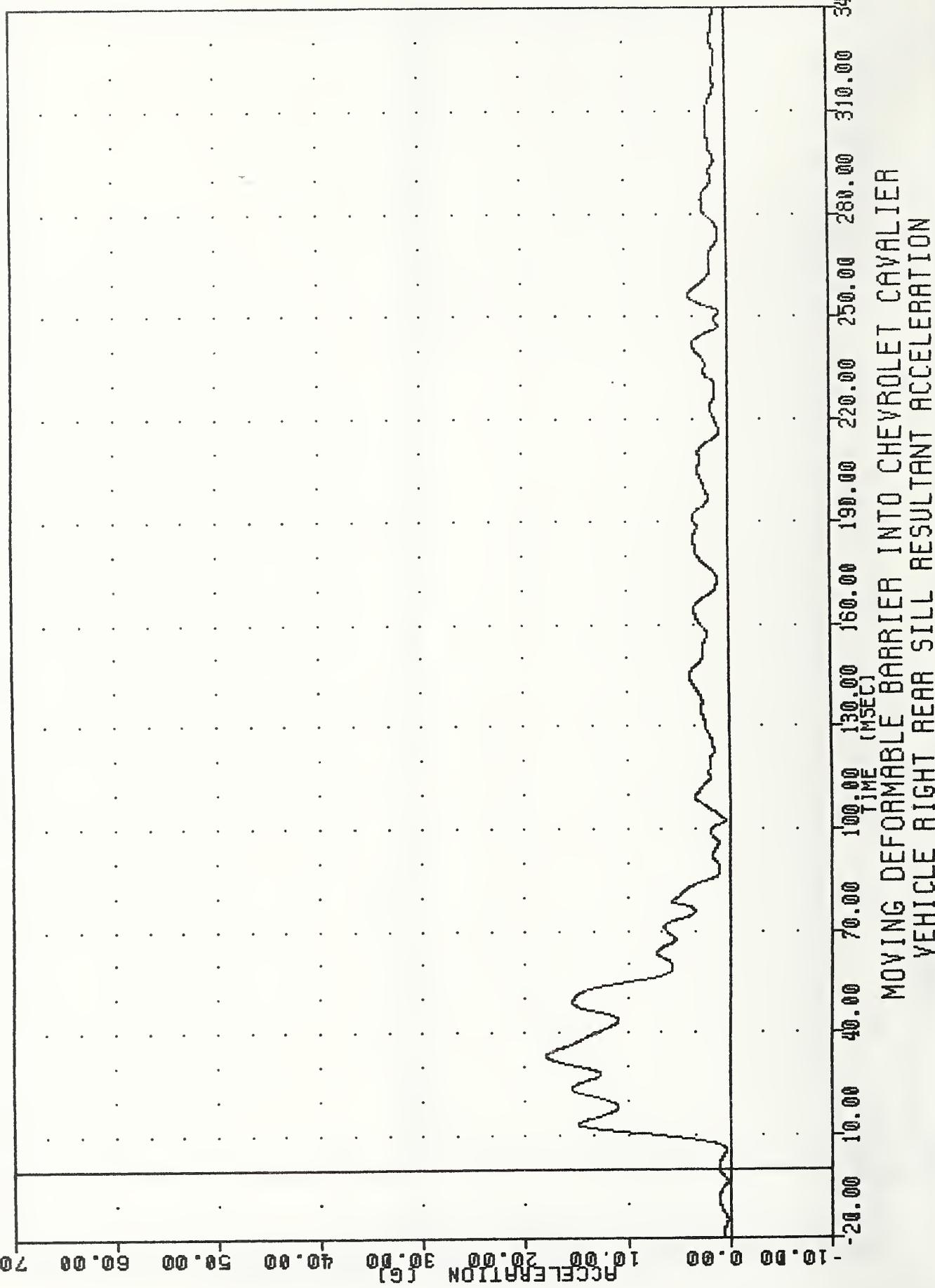
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
ARSIG

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -4.668 71.75 , 3.49 6 256.38



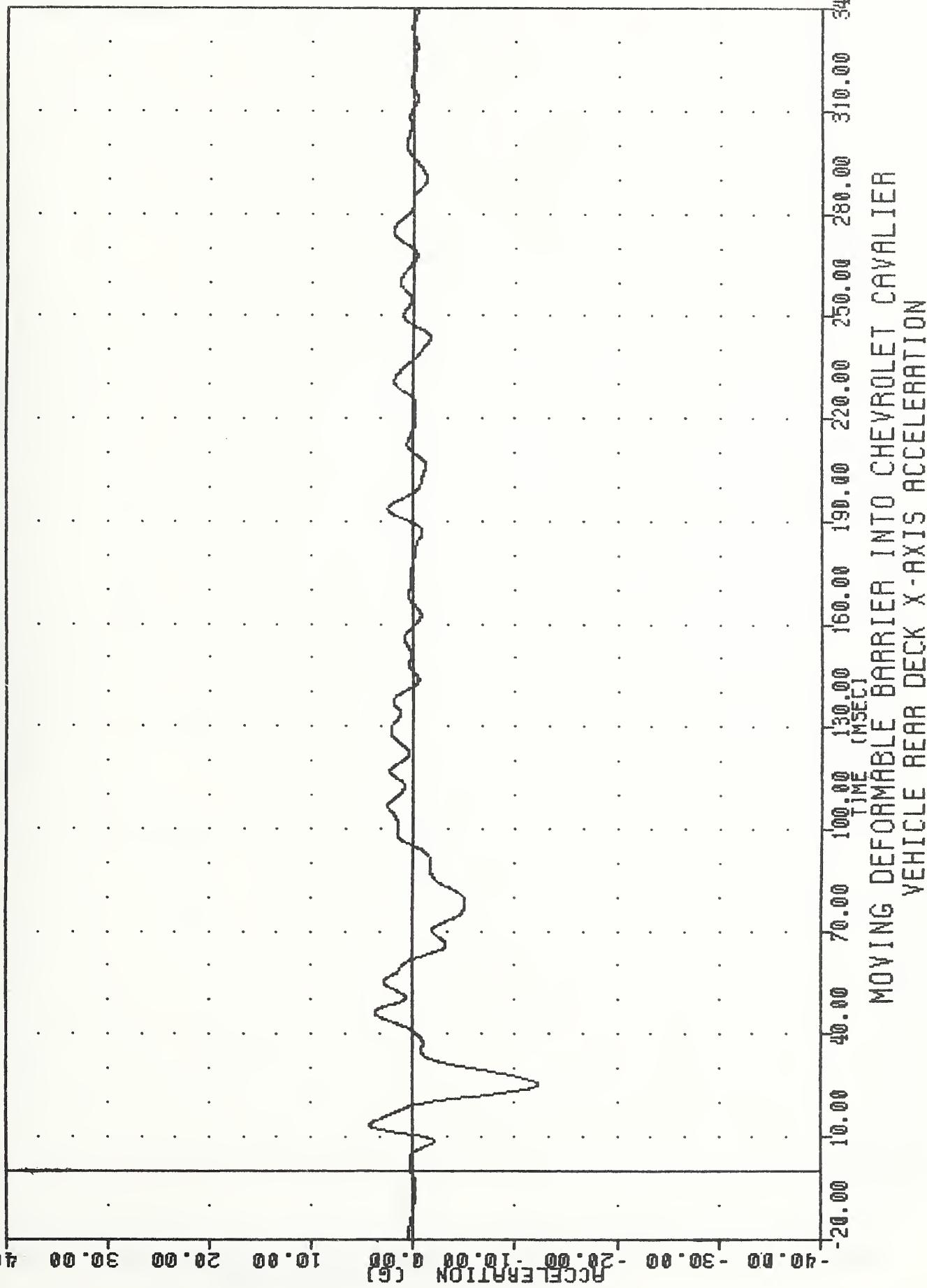
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
ARSRG

FILTER = BLPP 100/ 316/-40
MIN. MAX VALUES = 0.13@ -3.63 @ 17.95 @ 33.13



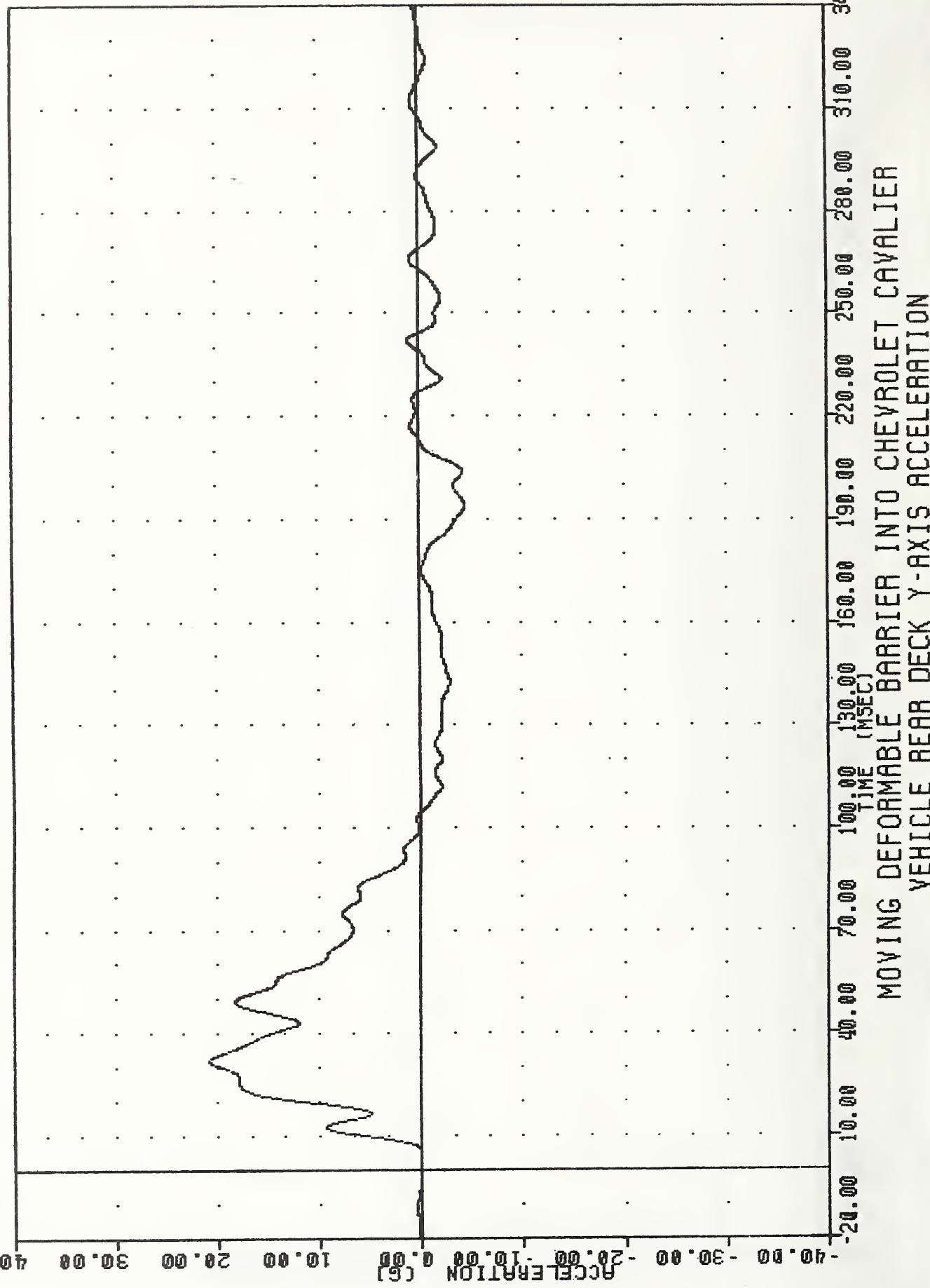
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
ADKXG

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -12.208 25.25 . 4.25 8 13.38



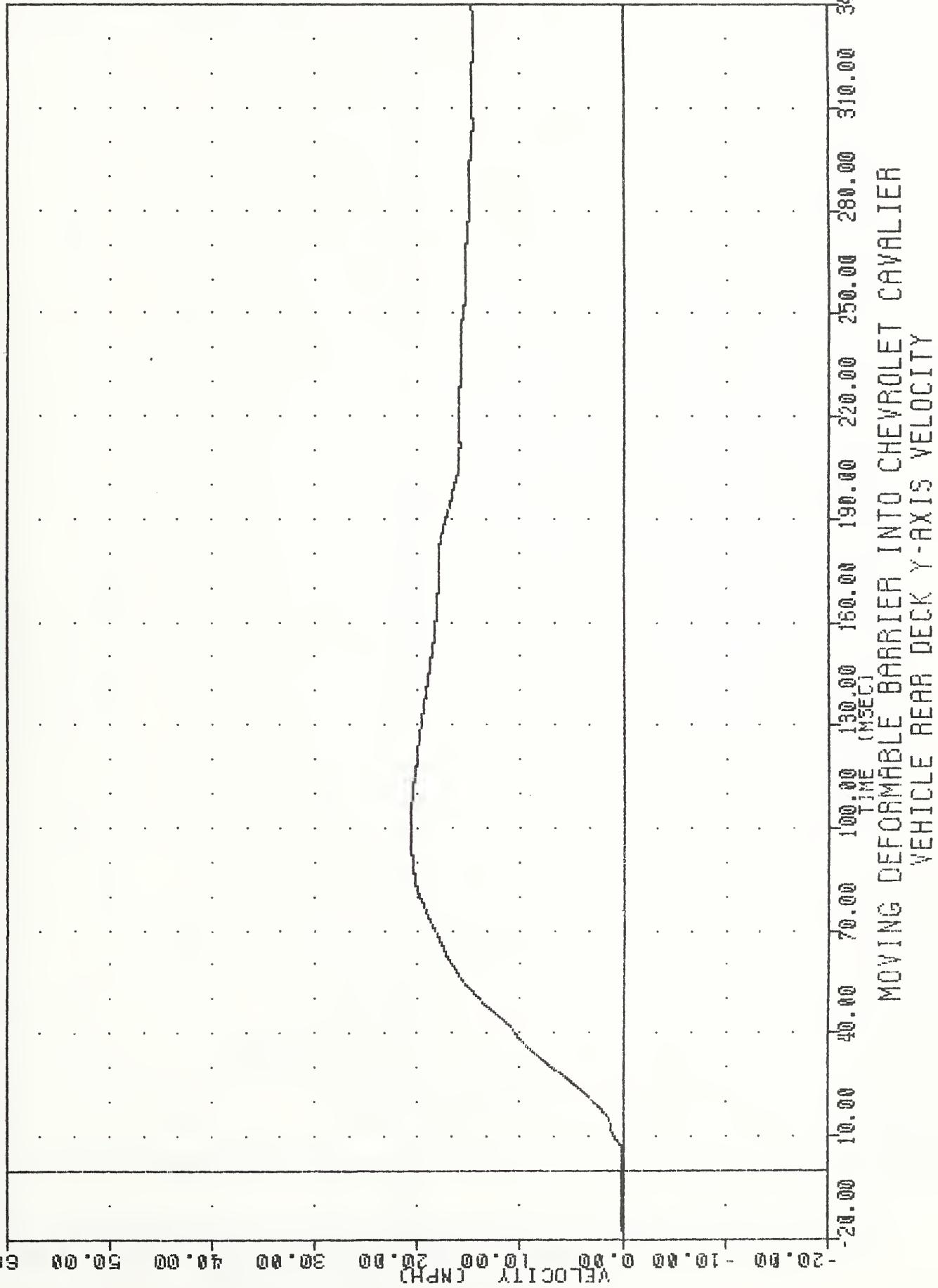
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
ADKYG

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -4.408 193.88 . 20.78 6 32.13

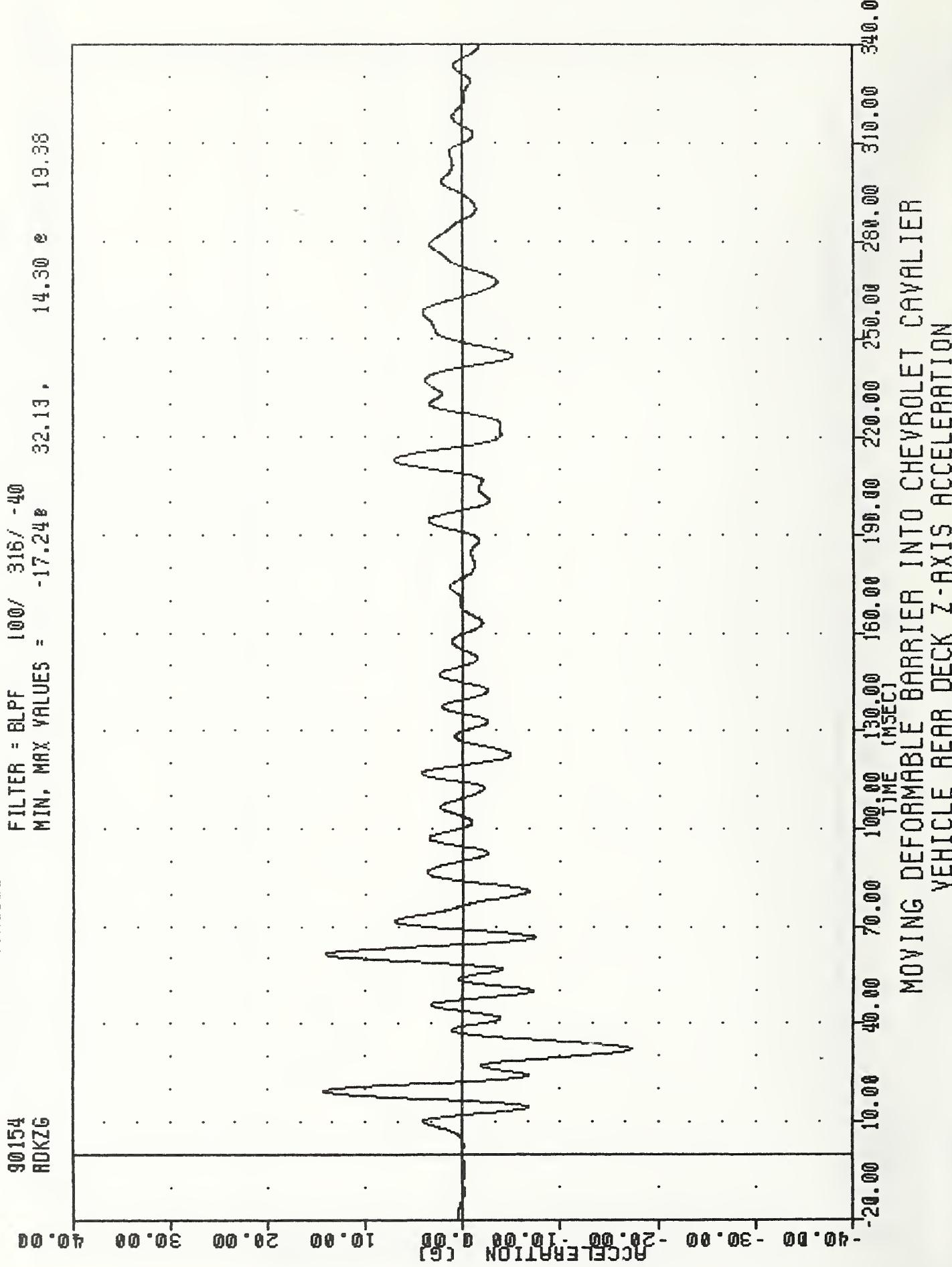


VRIC
SI PROTECTION PHAD VEHICLE
90154
ADKYY

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = 0.008 -20.00 , 20.69 & 102.25

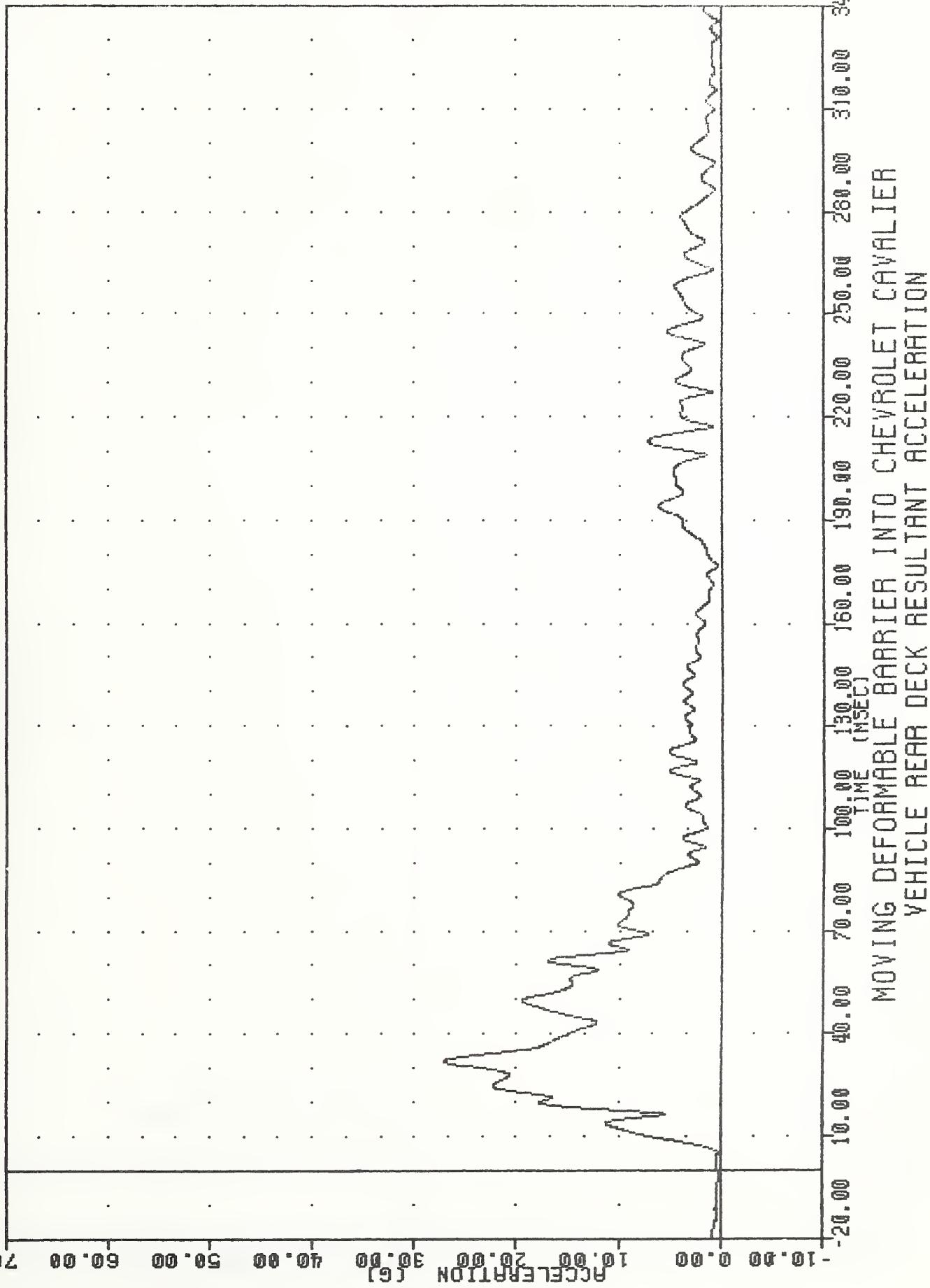


YRTC 900604
SI PROTECTION PROD VEHICLE
90154
RDKZ6



YRTC 900604
SI PROTECTION PROD VEHICLE
90154 ROKRG

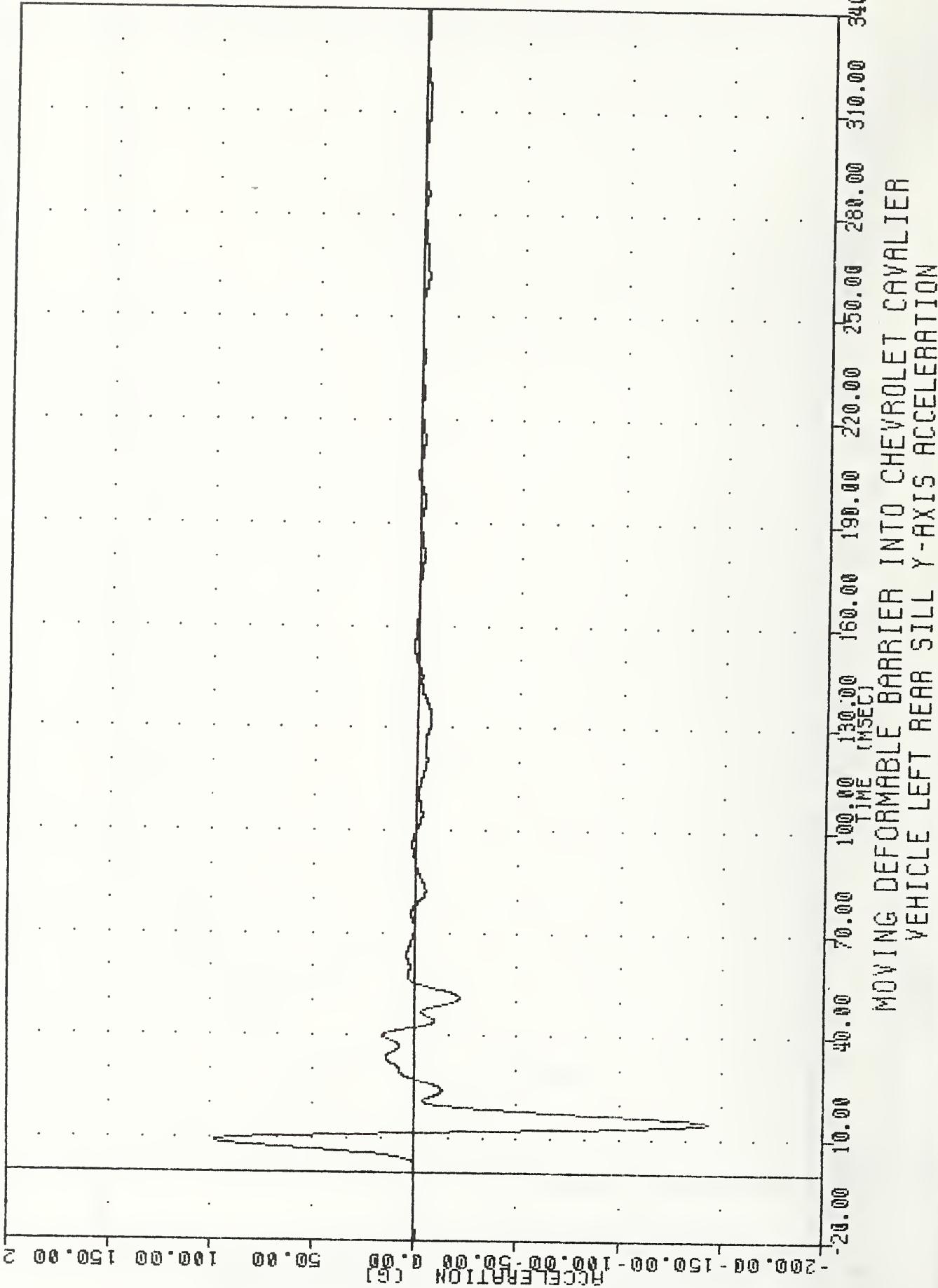
FILTER = BLPF 100/ 316/-40
MIN. MAX VALUES = 0.038 -1.88 . 27.11 @ 32.00



VRTC
SI PROTECTION PROD VEHICLE
90154
LRSYG

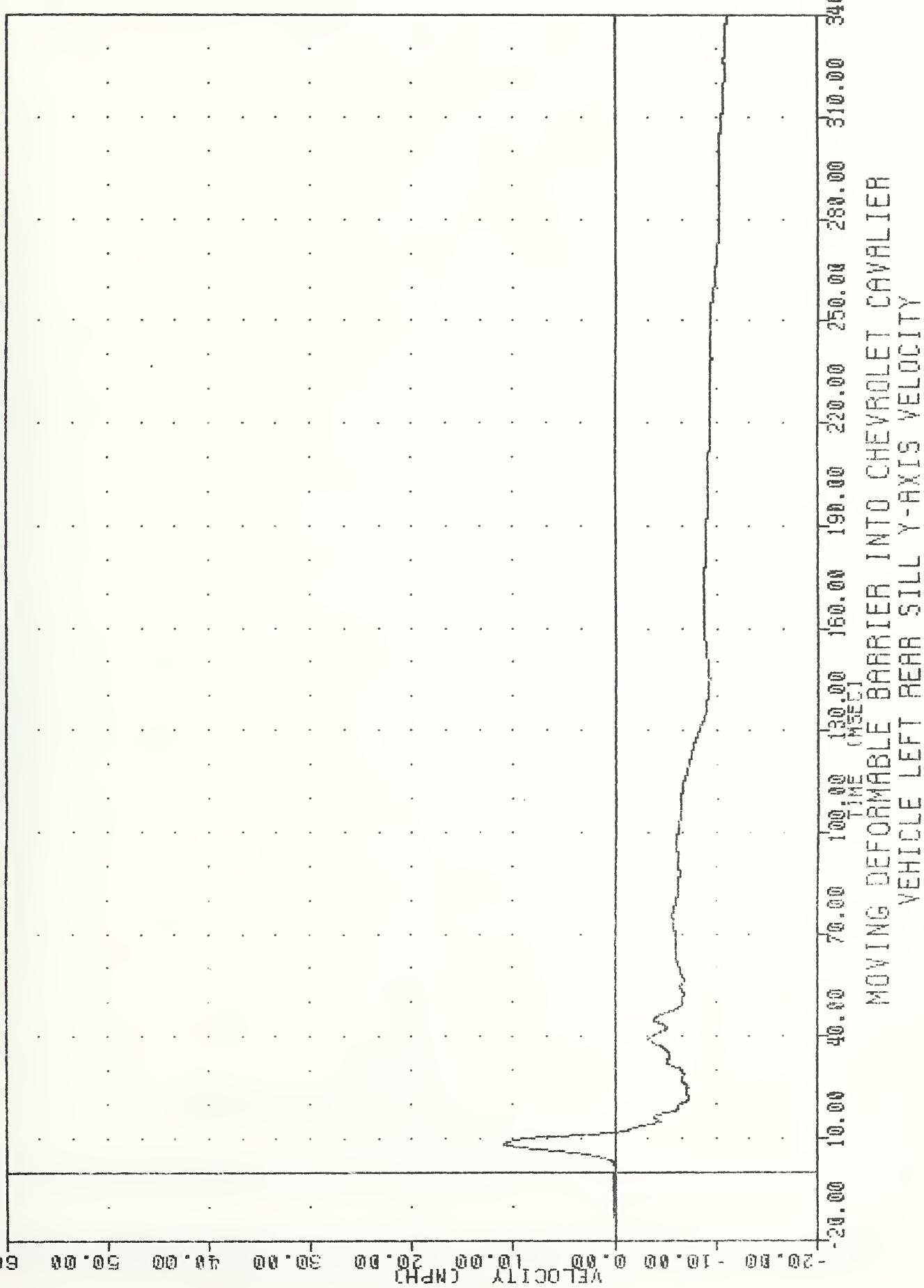
FILTER = BLPF 100/ 316/-40
MIN. MAX VALUES = -144.148 14.75 ,

97.96 @ 9.13



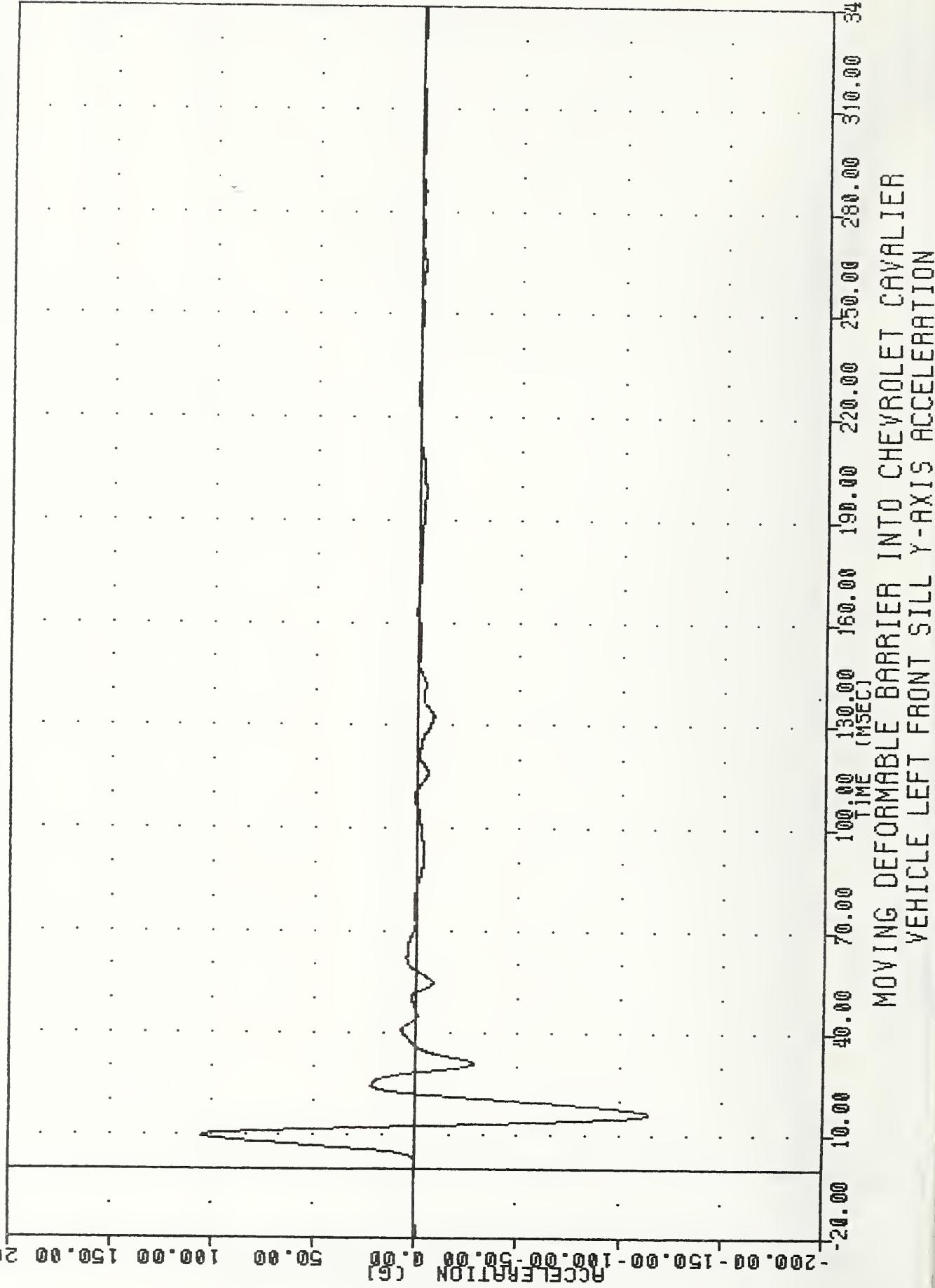
YRTC 900604
SI PROTECTION PROD VEHICLE
30154 LRSYV

FILTER = BLFF 300/-40
MIN, MAX VALUES = -11.07e 340.00 . 10.86 e 8.25



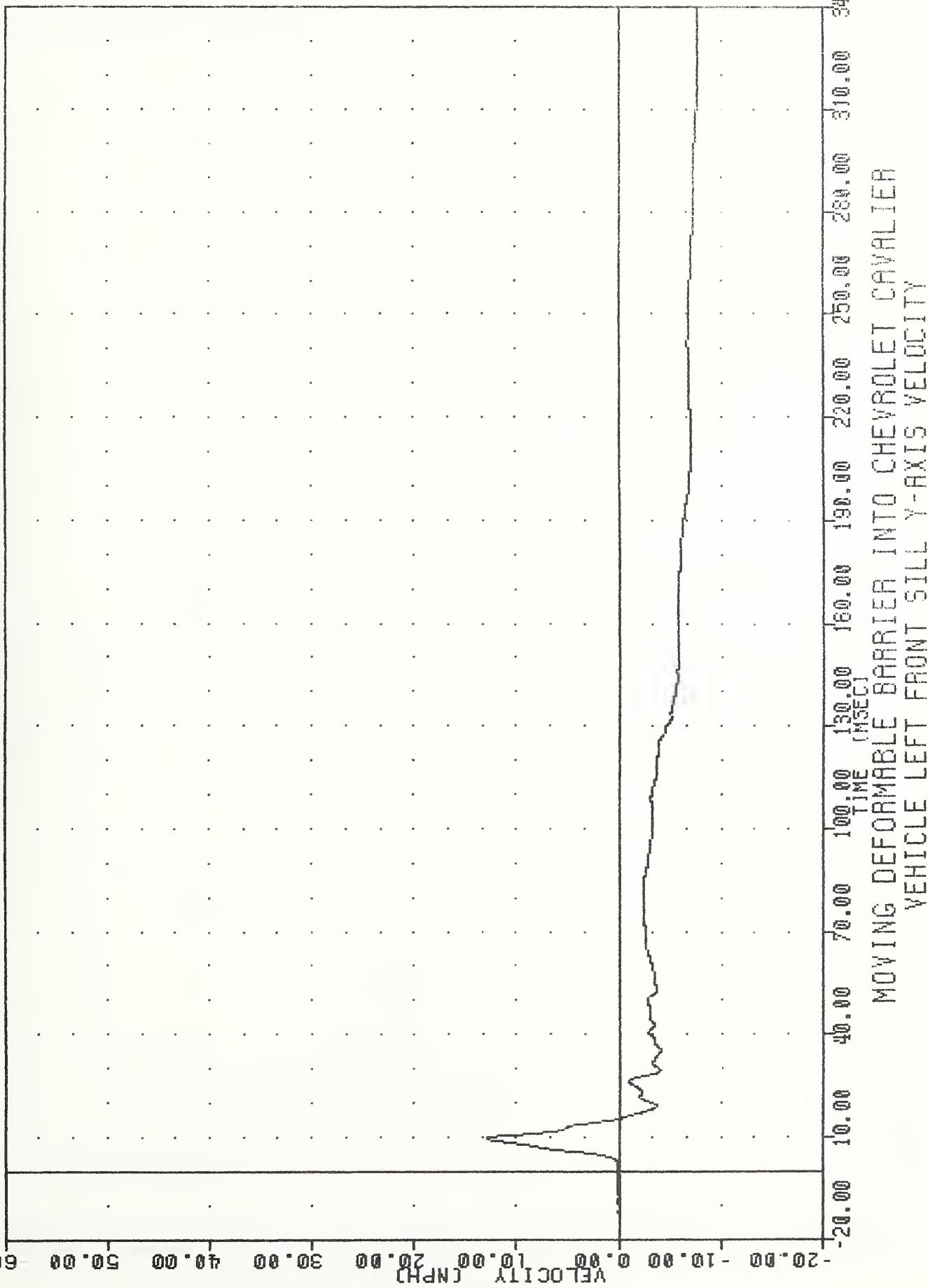
VRTC
SI PROTECTION PROD VEHICLE
9@154
LFSYG

900604
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -114.78@ 16.13 , 104.75 @ 9.63



YATC 900604
SI PROTECTION PROD VEHICLE
90154
LFSYV

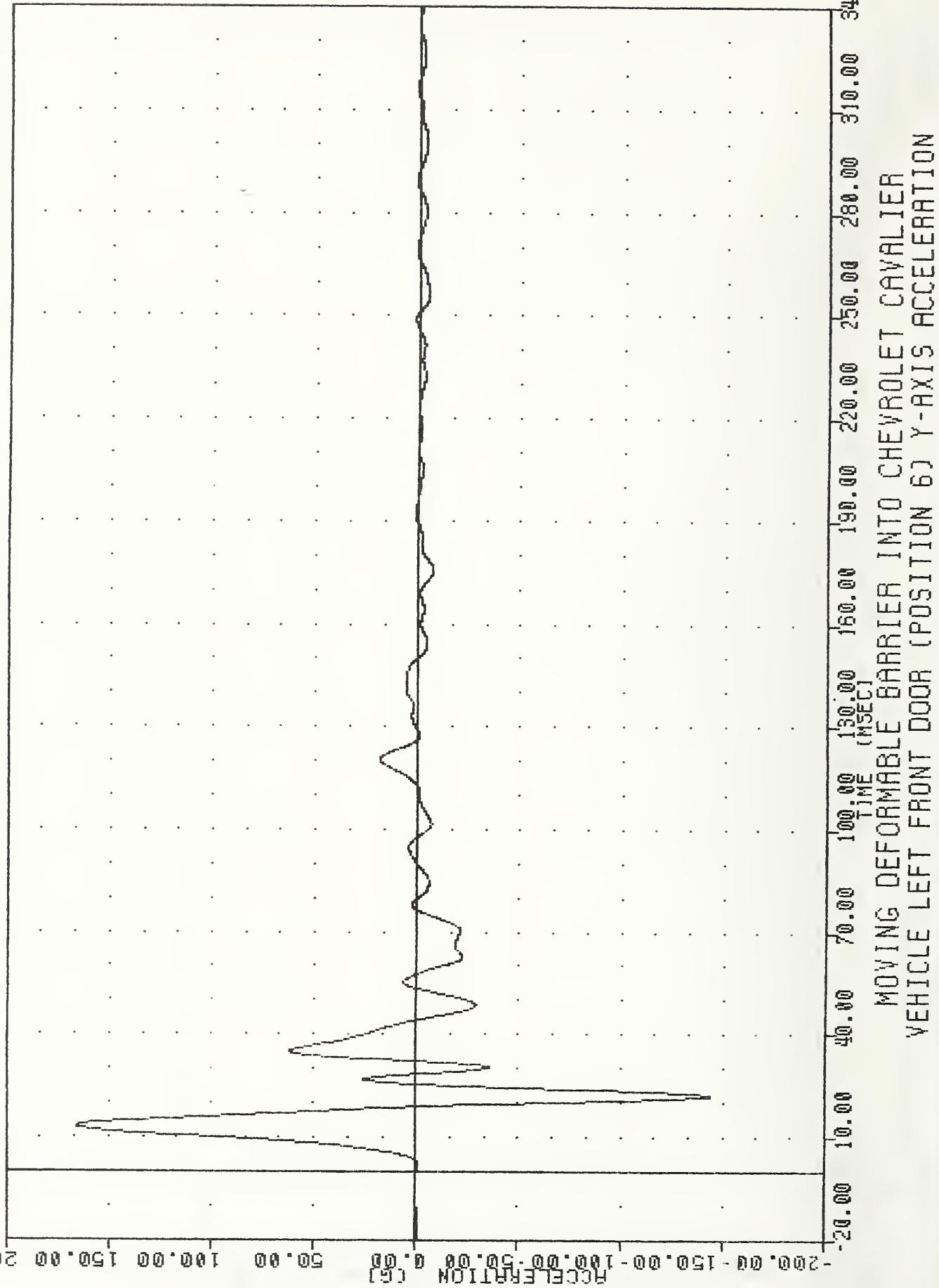
FILTER = BLPF 3000/
MIN, MAX VALUES = -7.780 339.13 , 12.67 @ 9.63



Moving deformable barrier into Chevrolet Cavalier
Vehicle left front sill y-axis velocity

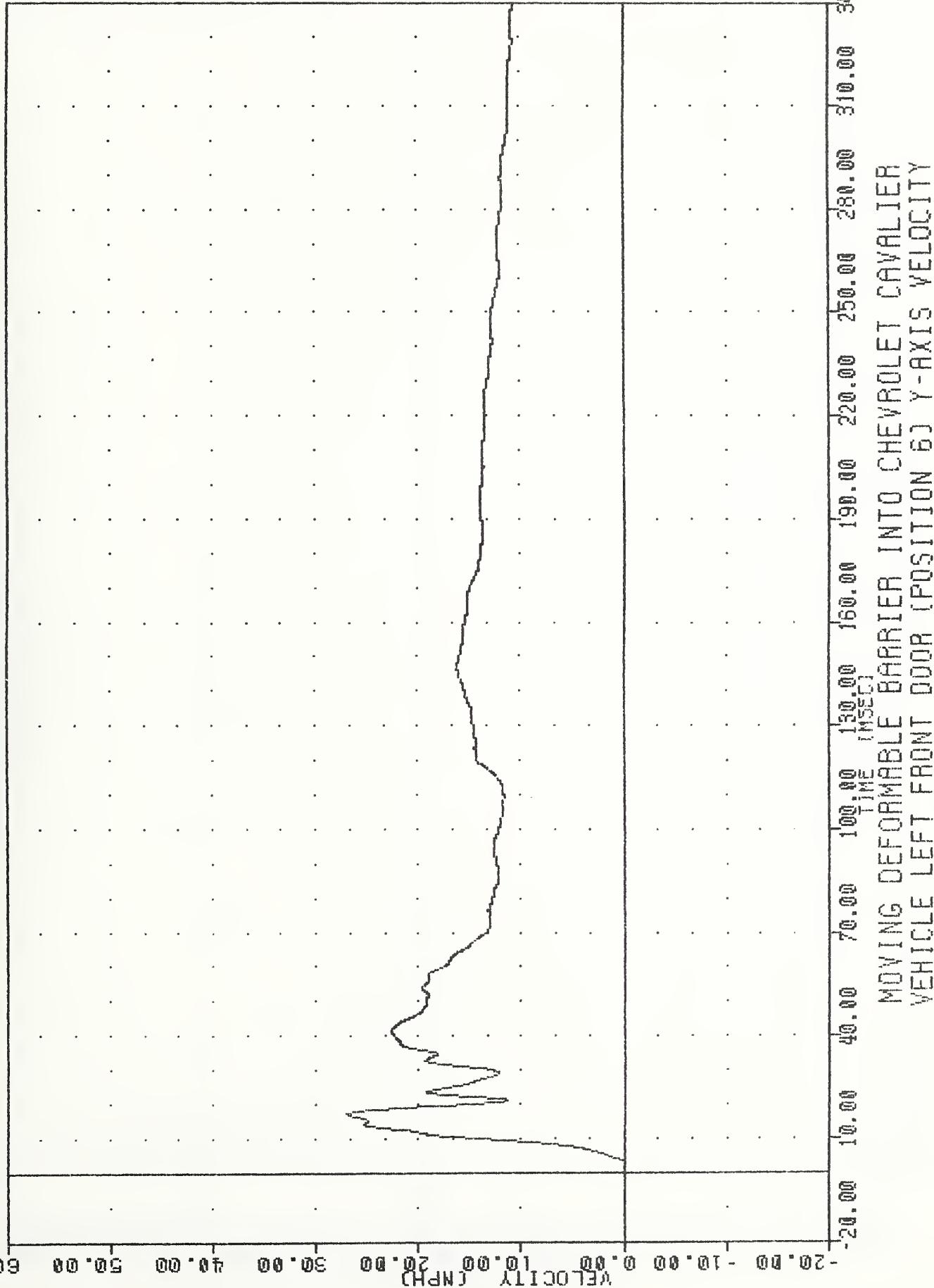
YRTC
SI PROTECTION PROD VEHICLE
90154
LFDY61

FILTER = BLFF 100/ 316/ -40
MIN, MAX VALUES = -144.300 22.00 , 165.68 & 13.13



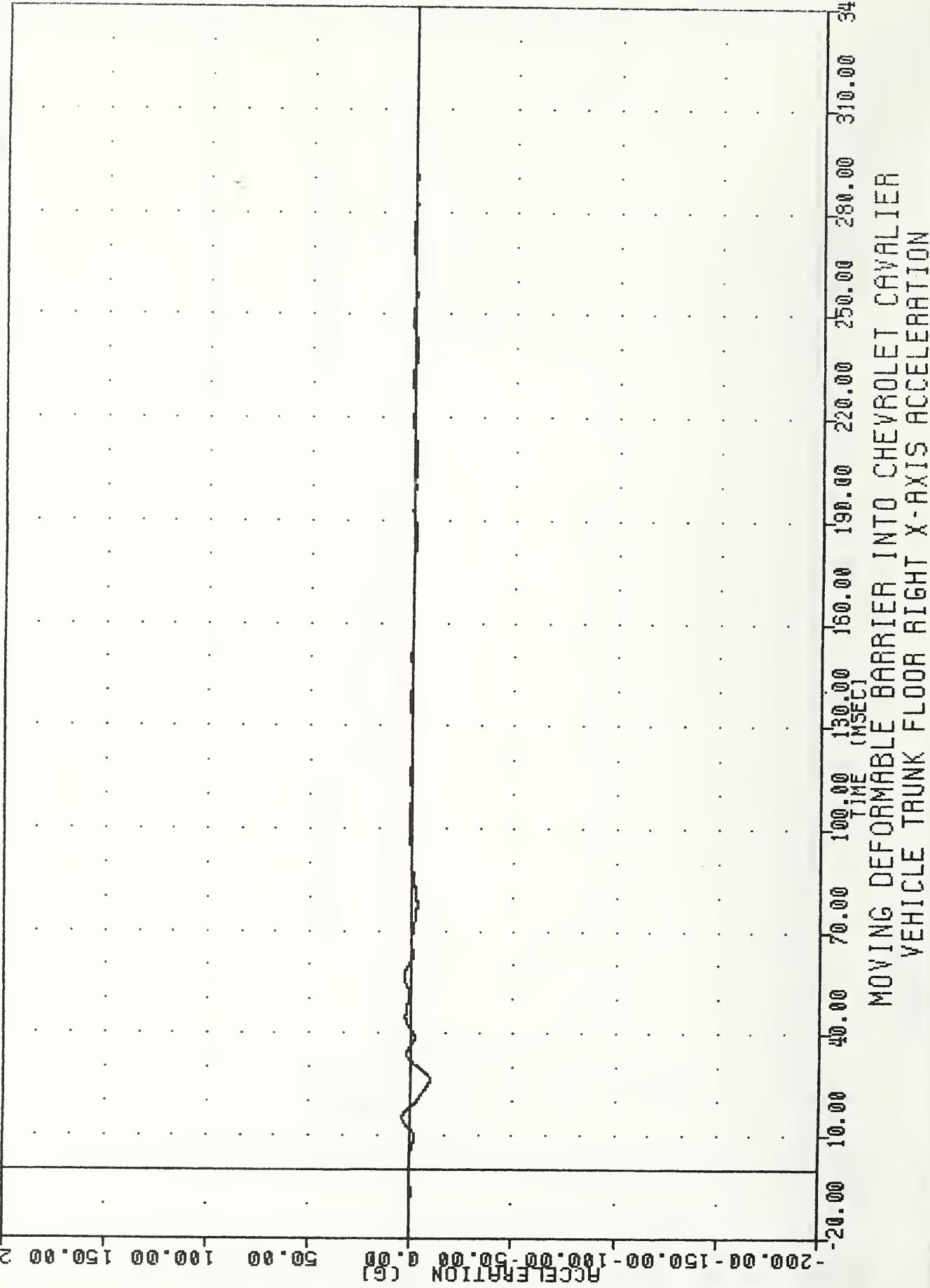
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
LFDYY1

FILTER = BLPF 3000/ 949/-40
MIN, MAX VALUES = -0.128 -13.75 , 26.95 & 17.25



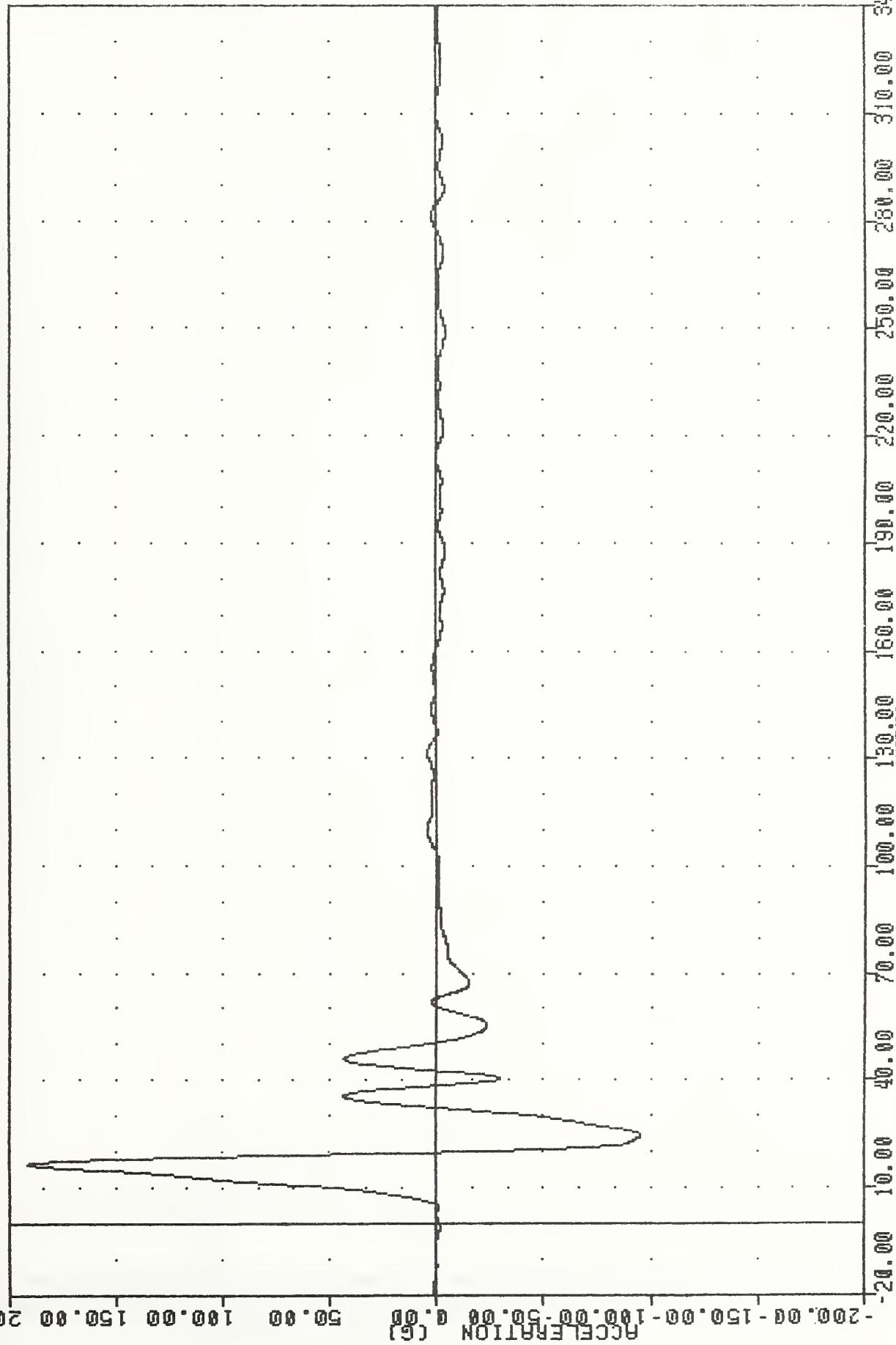
YRTC, 900604
SI PROTECTION FROM VEHICLE
90154 TFRX6

FILTER = BLPF 100/ 316/-40
MIN, MAX VALUES = -9.288 26.13 , 4.13 & 15.00



VRTC
SI PROTECTION PROD VEHICLE
9@154
LR0Y62

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -95.43 e 24.50 . 190.64 e 16.50

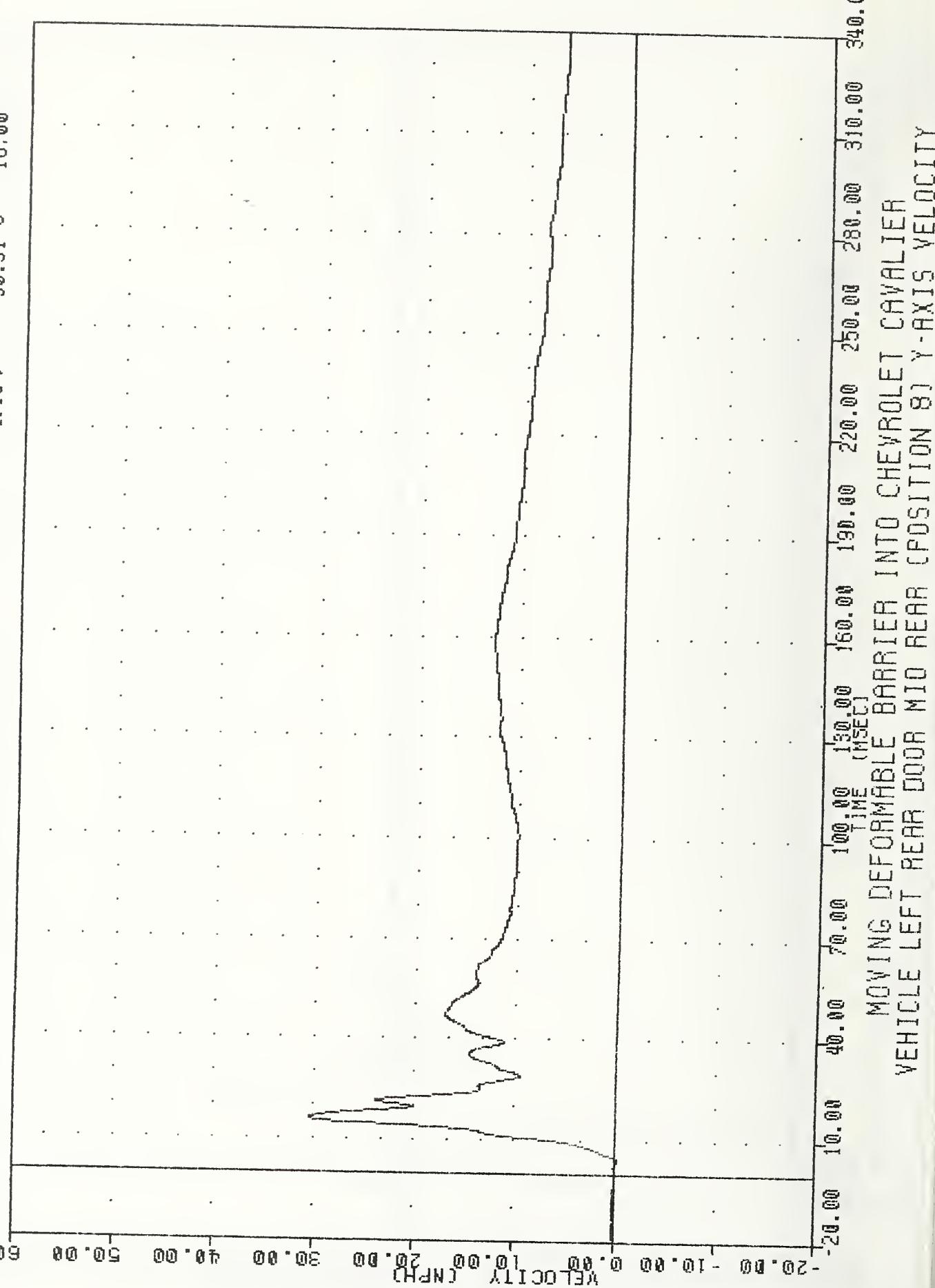


TIME [MSEC]
MOVING DEFORMABLE BARRIER INTO CHEVROLET CAVALIER
VEHICLE LEFT REAR DOOR MID REAR (POSITION 8) Y-AXIS ACCELERATION

YRTC
SI PROTECTION PROD VEHICLE
90154

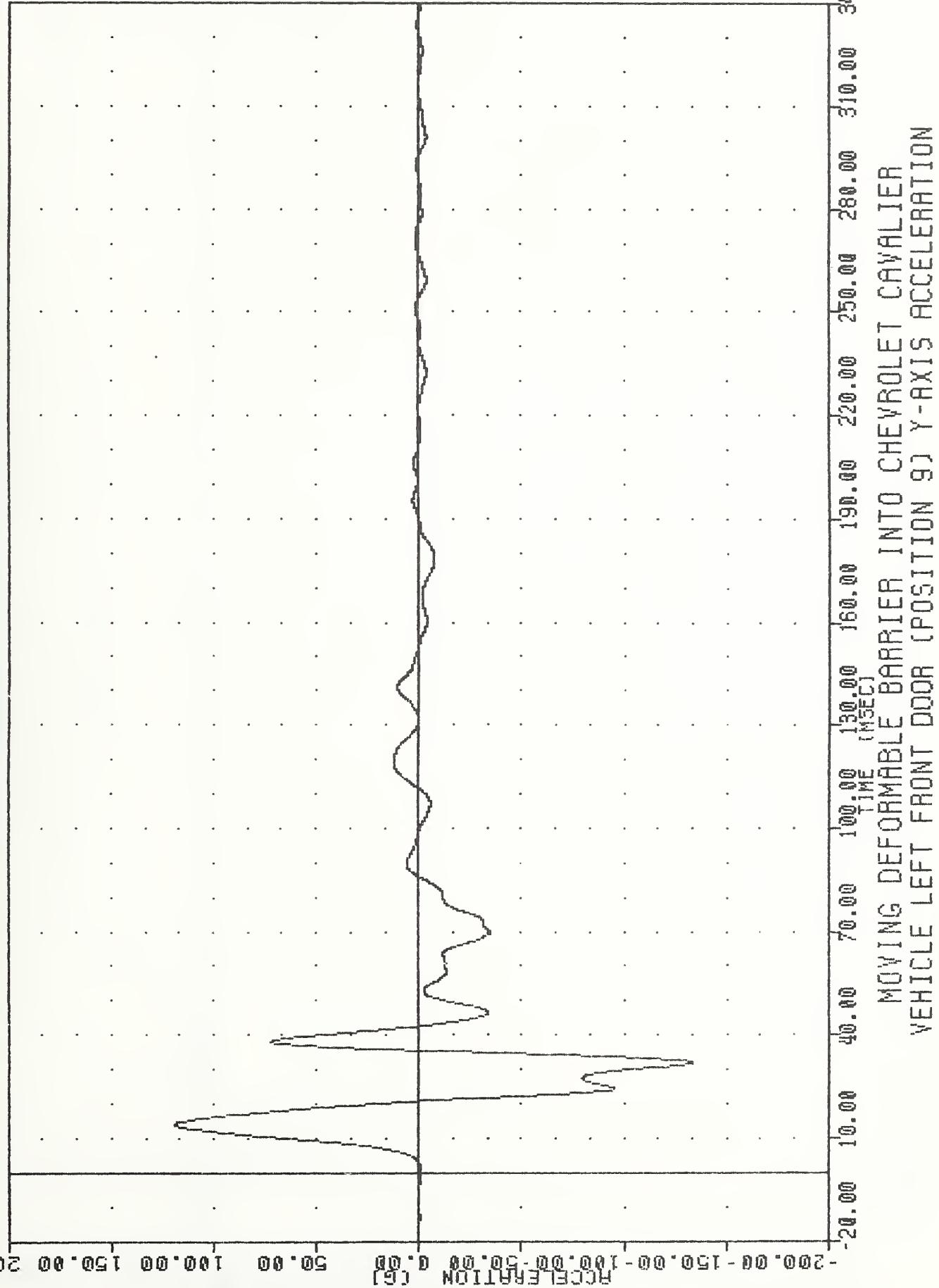
L02y2

FILTER = BLFF 300/ 949/ -40
MIN, MAX VALUES = -0.358 4.13 • 30.51 & 16.00

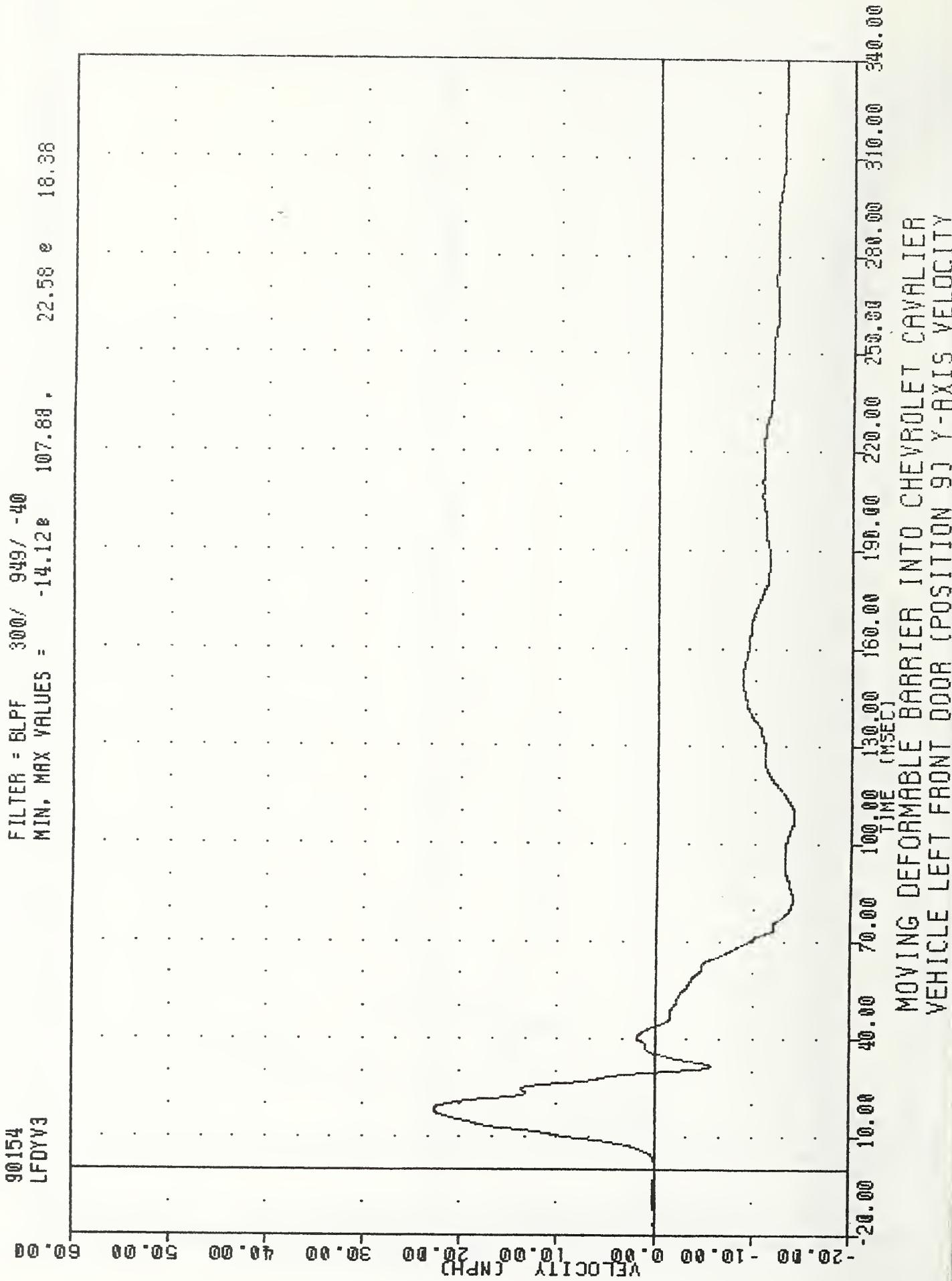


YRTC 900604
SI PROTECTION PROD VEHICLE
90154 LFDY63

FILTER = BLFF 100/-316/-40
MIN, MAX VALUES = -133.288 32.00 , 118.81 & 14.00

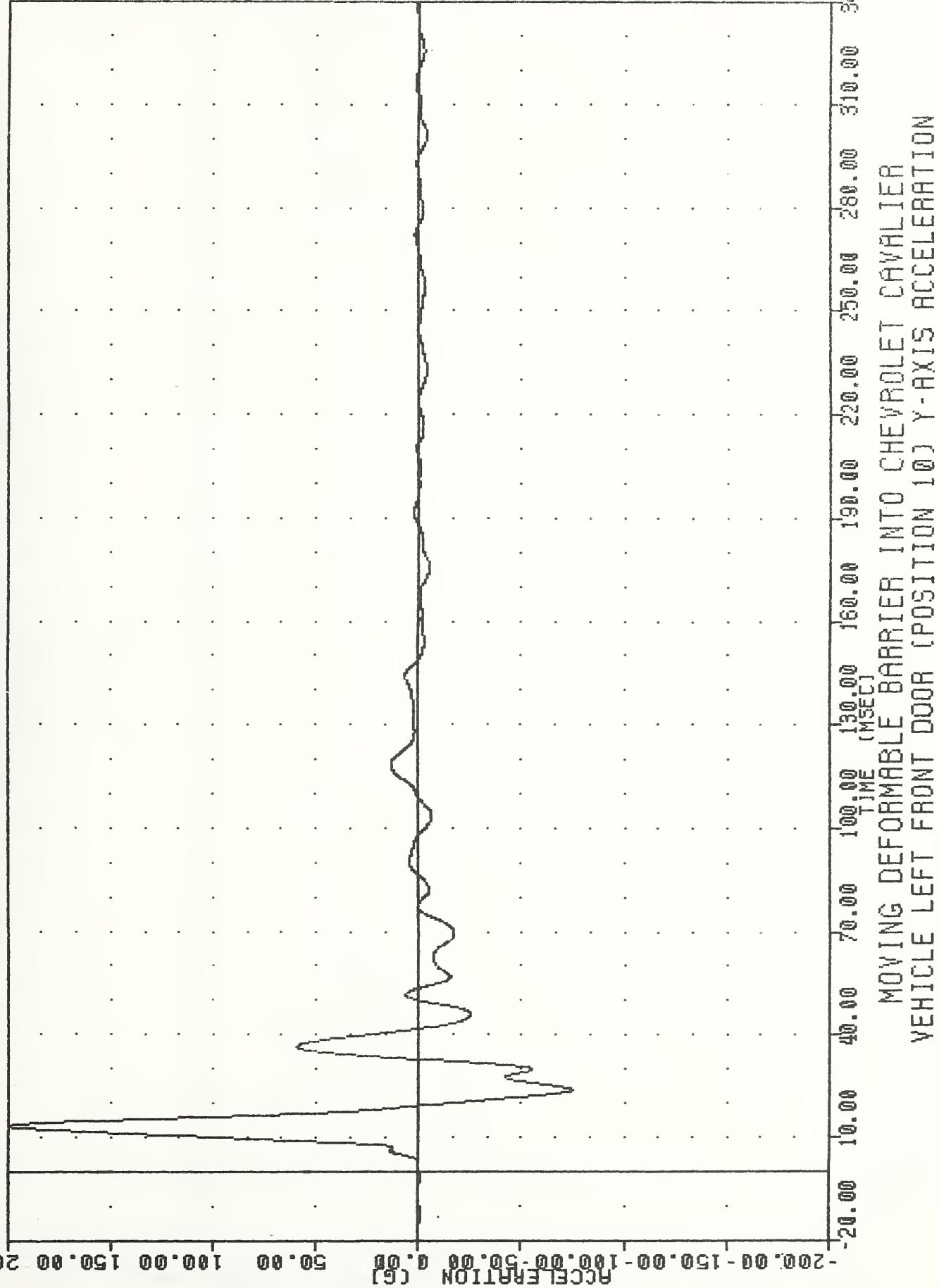


VRTC 900604
SI PROTECTION PROD VEHICLE
9@154
LFDYV3



YRTC 900604
SI PROTECTION PROD VEHICLE
90154 LFDY64

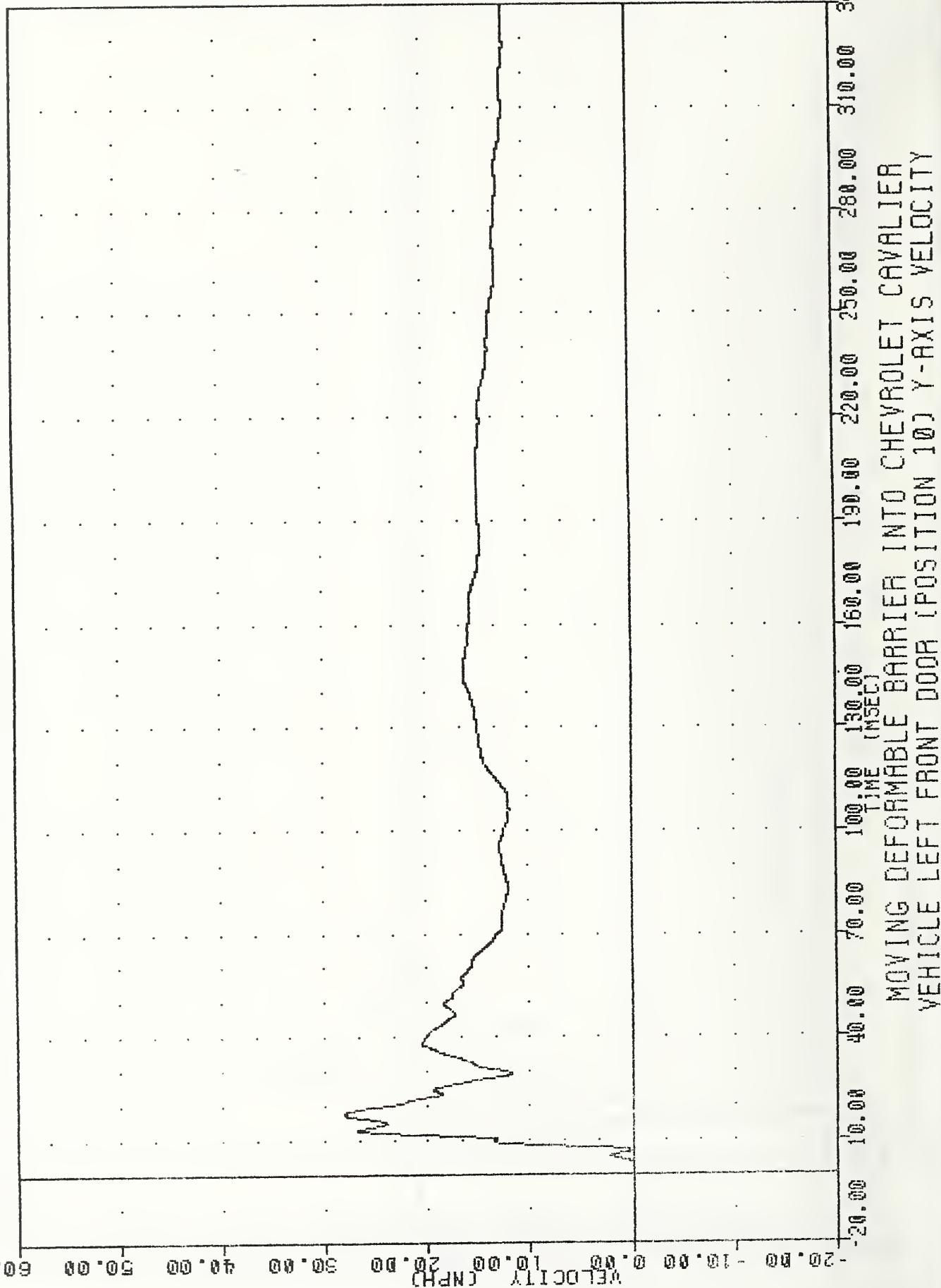
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -74.748 23.75 . 189.14 & 13.25



VRTC , 900604
SI PROTECTION PROD VEHICLE
9@154
LFDY44

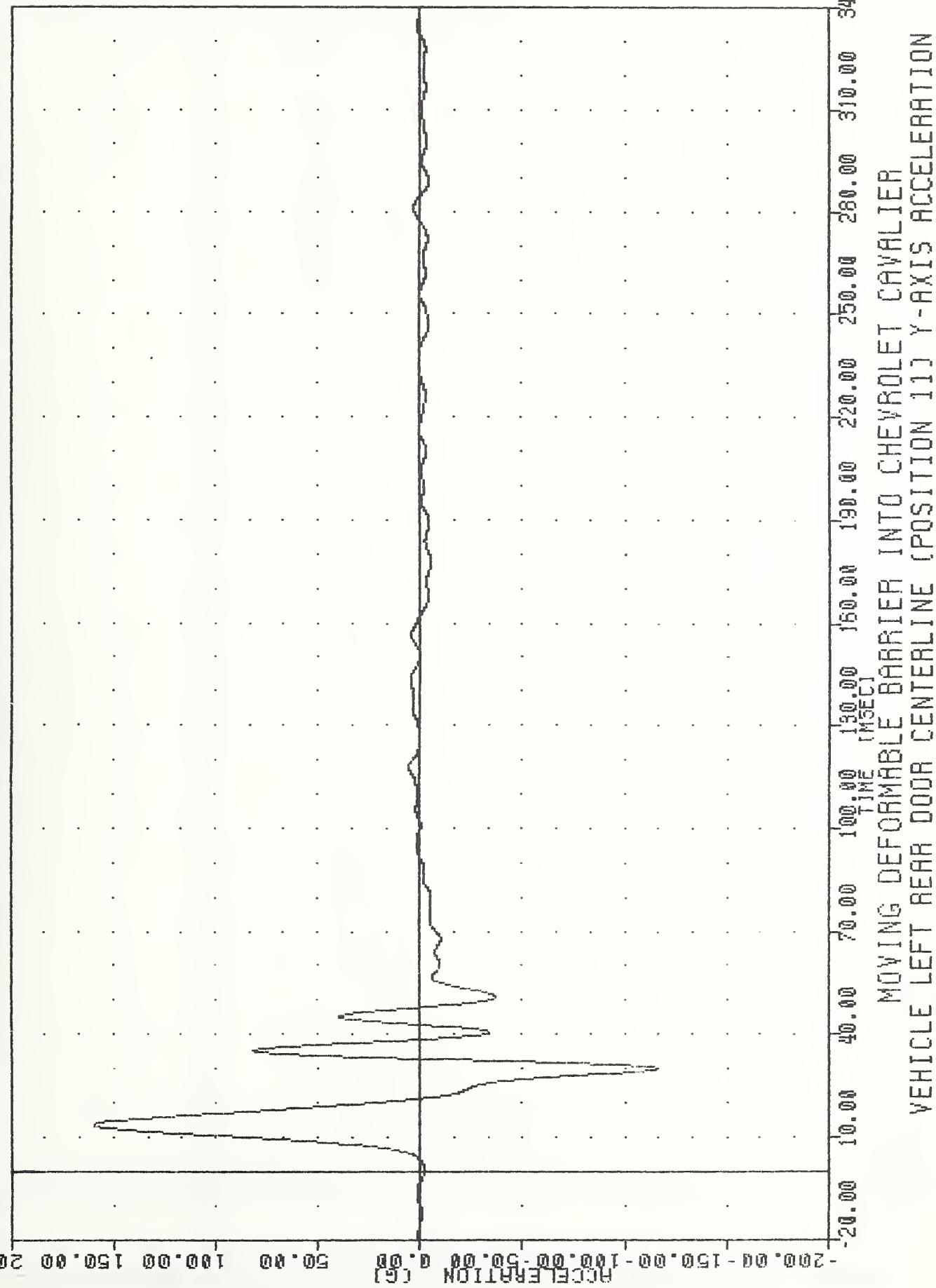
FILTER = BLPF 300/
MIN. MAX VALUES = 949/-40
 -0.12@ -13.8@ .

28.15 @ 17.63



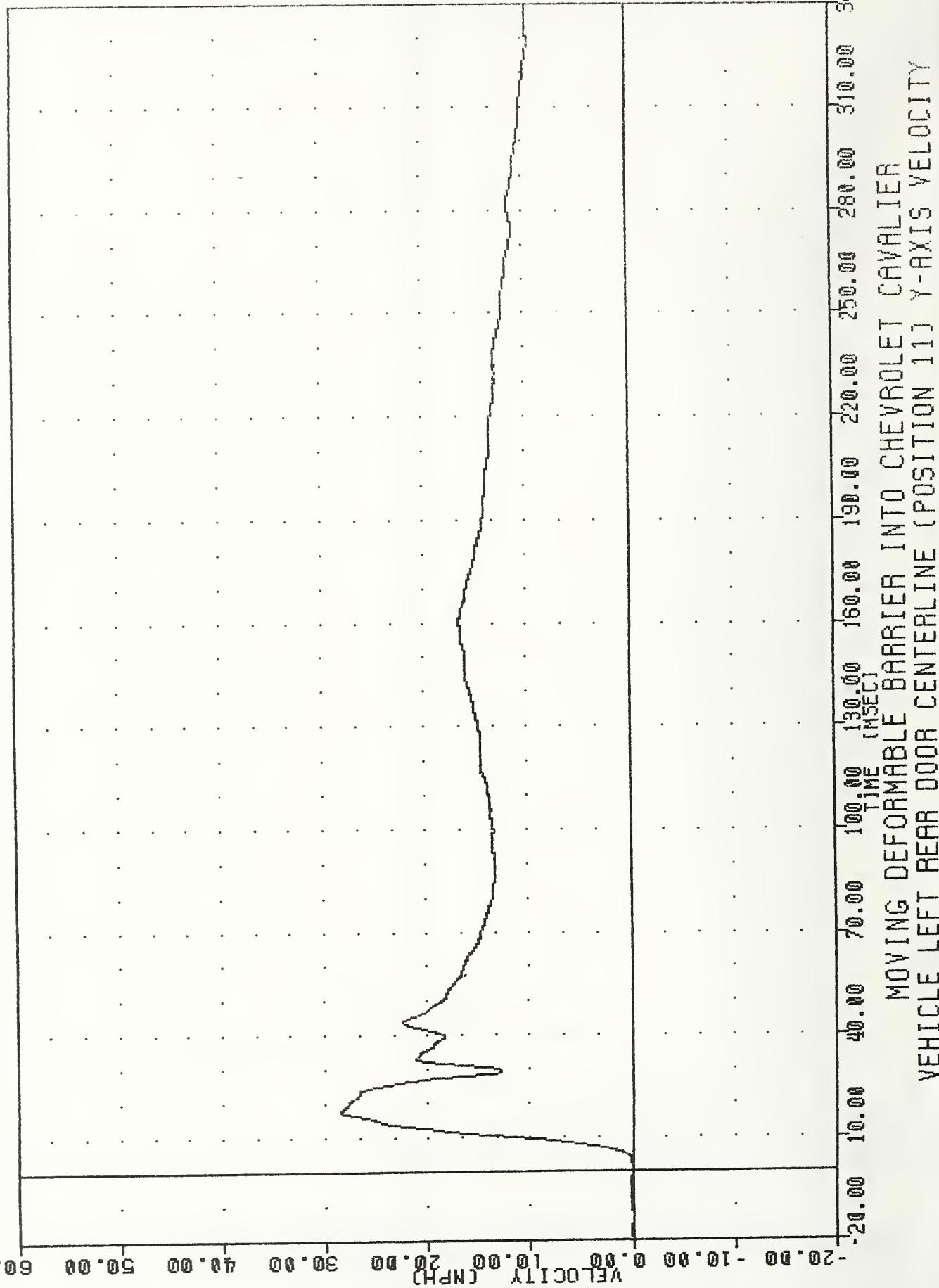
WRTC 900604
SI PROTECTION PROD VEHICLE
90154
LRDY65

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -116.618 30.00 159.778 13.63



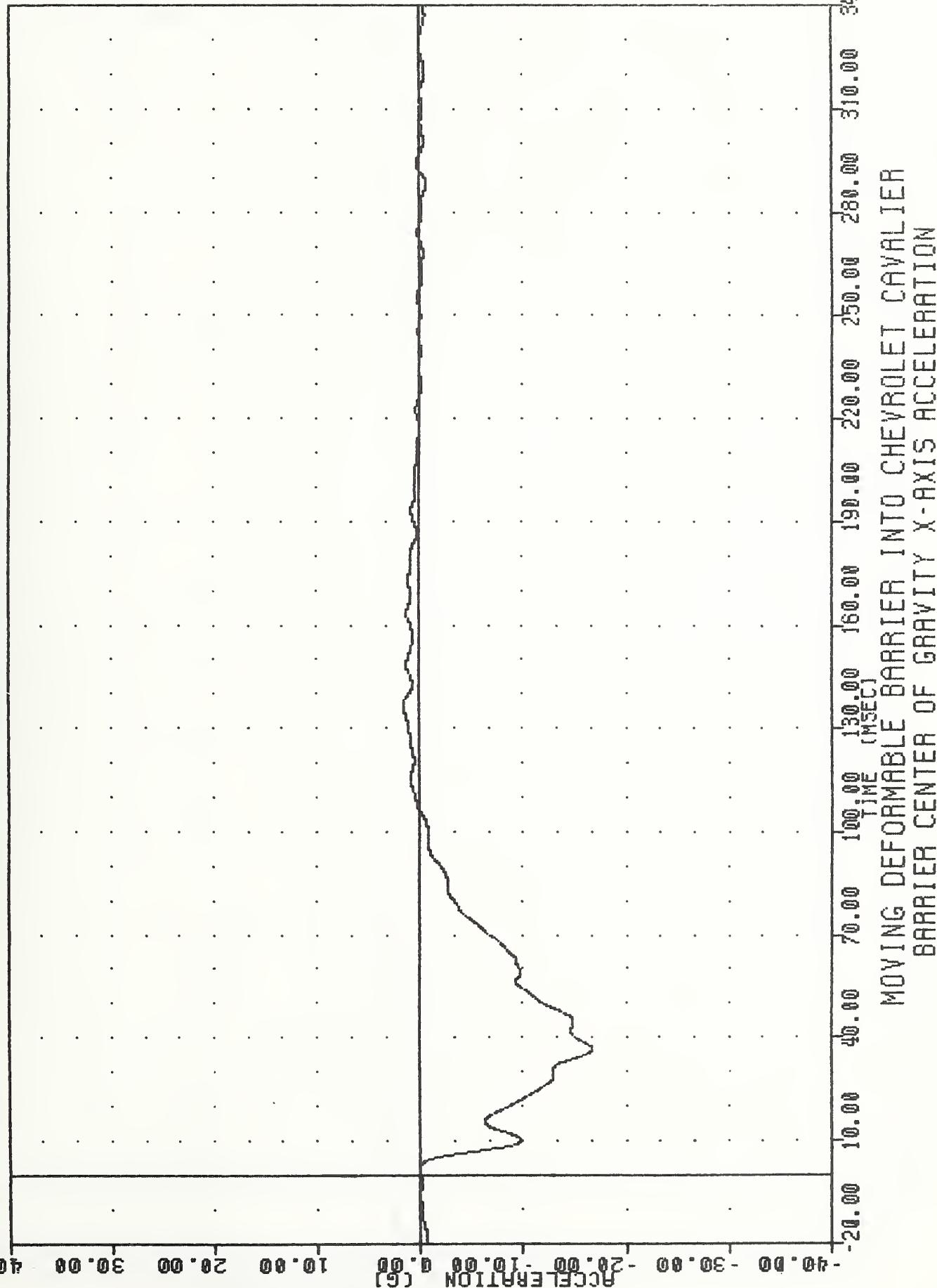
VRTC 900604
SI PROTECTION PROD VEHICLE
90154
LR0Y5

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -0.078 -14.00 -28.55 8 17.63



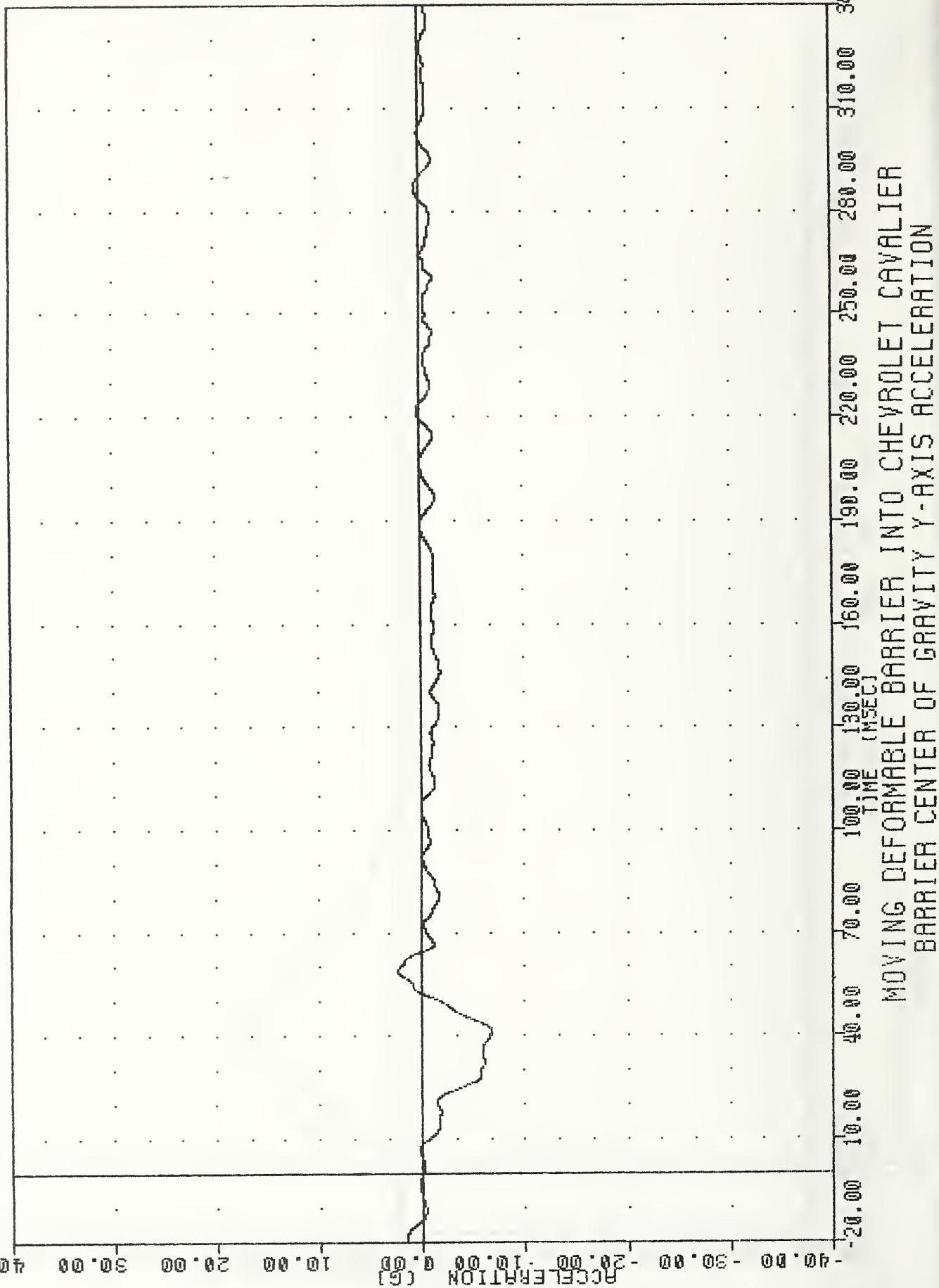
YRTC 900604
SI PROTECTION PROD VEHICLE
90154 BCGX6

FILTER = BLRF 100/-316/-40
MIN. MAX VALUES = -16.818 36.63 , 1.53 @ 137.00



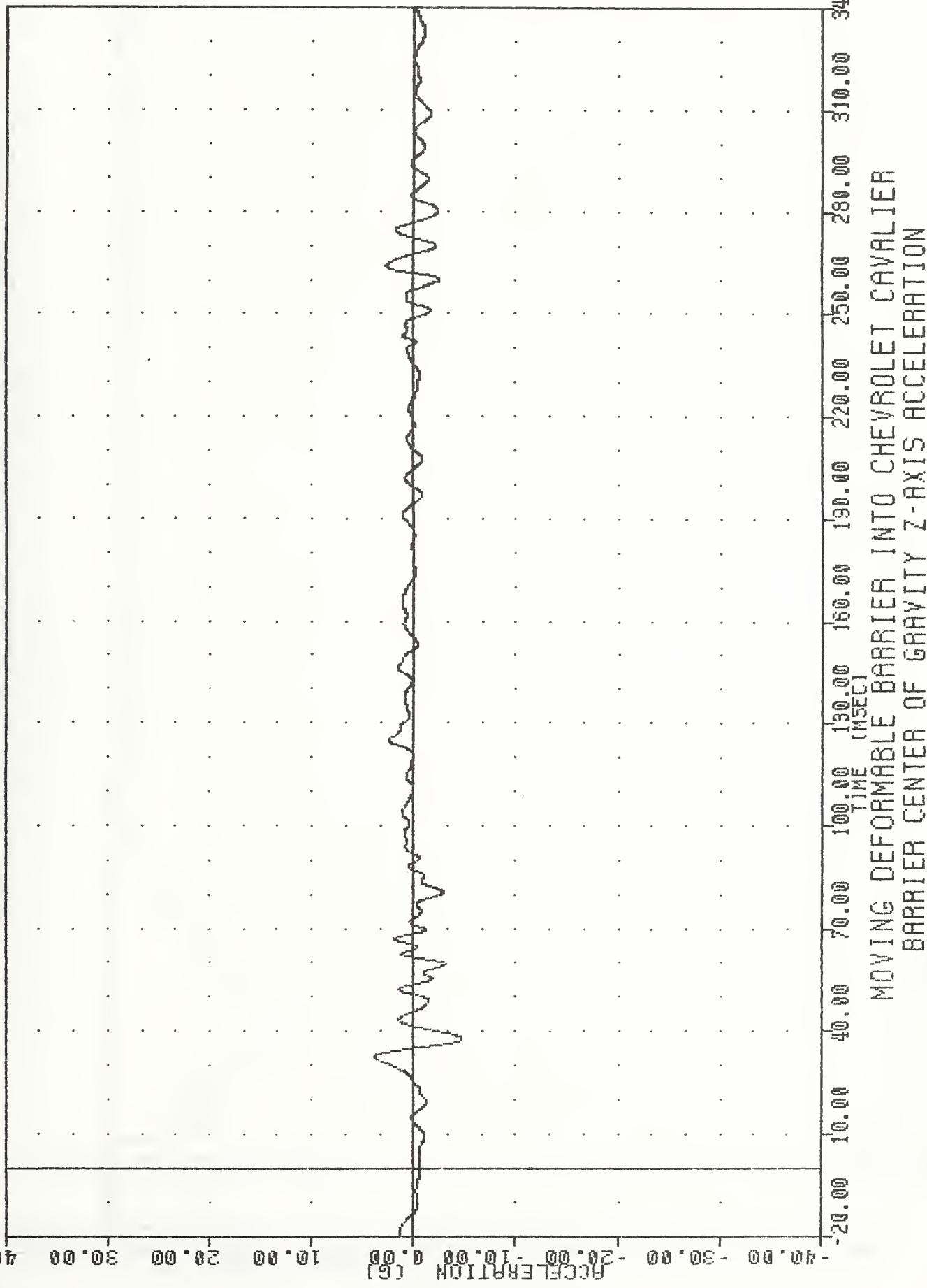
YRTC, 900604
SI PROTECTION PROD VEHICLE
90154
BC6Y6

FILTER = ELPF 100/ 316/-40
MIN, MAX VALUES = -6.708 41.50 , 2.36 8 58.75



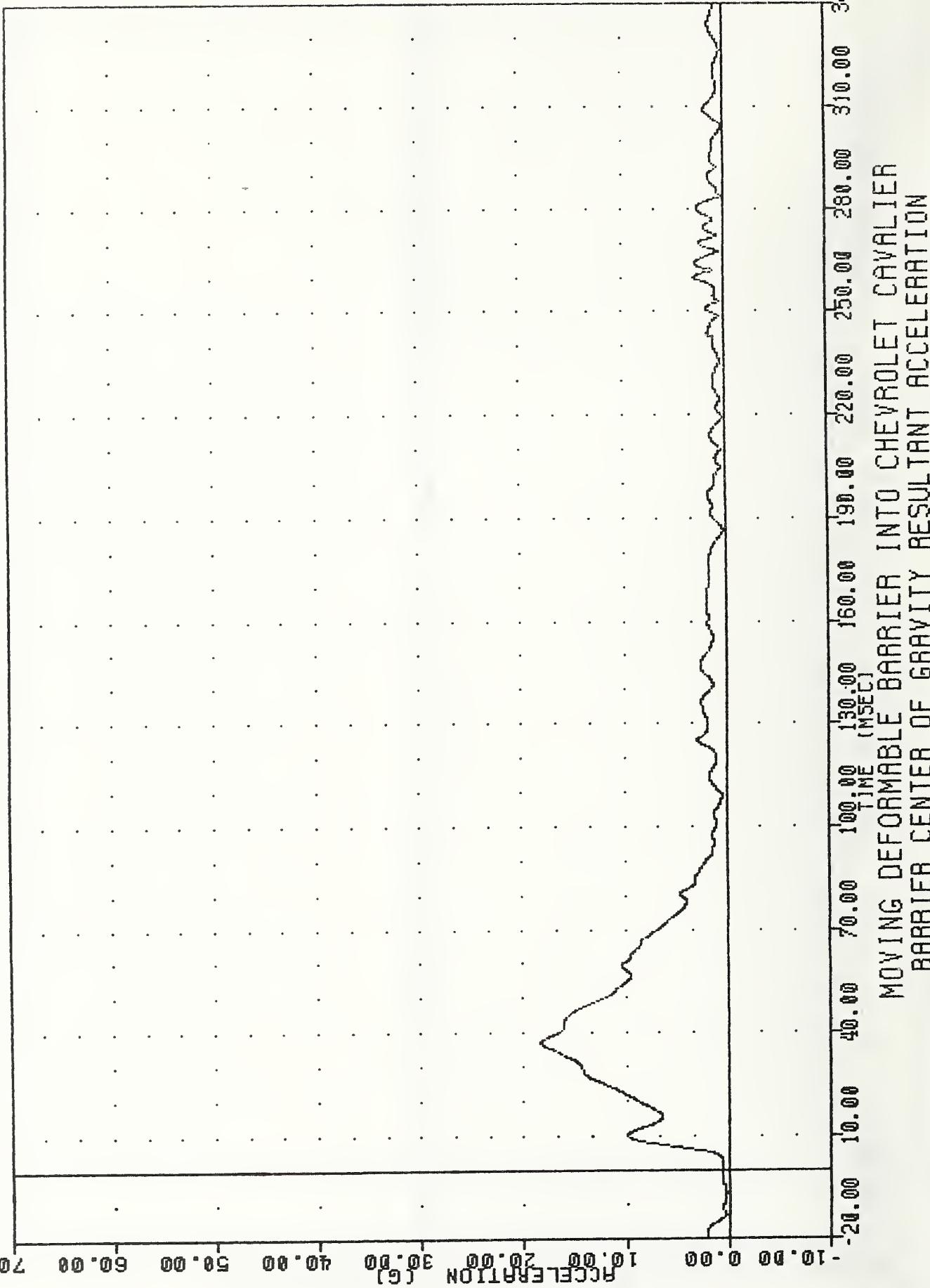
YRTC 900604
SI PROTECTION PROD VEHICLE
90154
80616

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -4.718 37.75 , 3.87 8 32.50

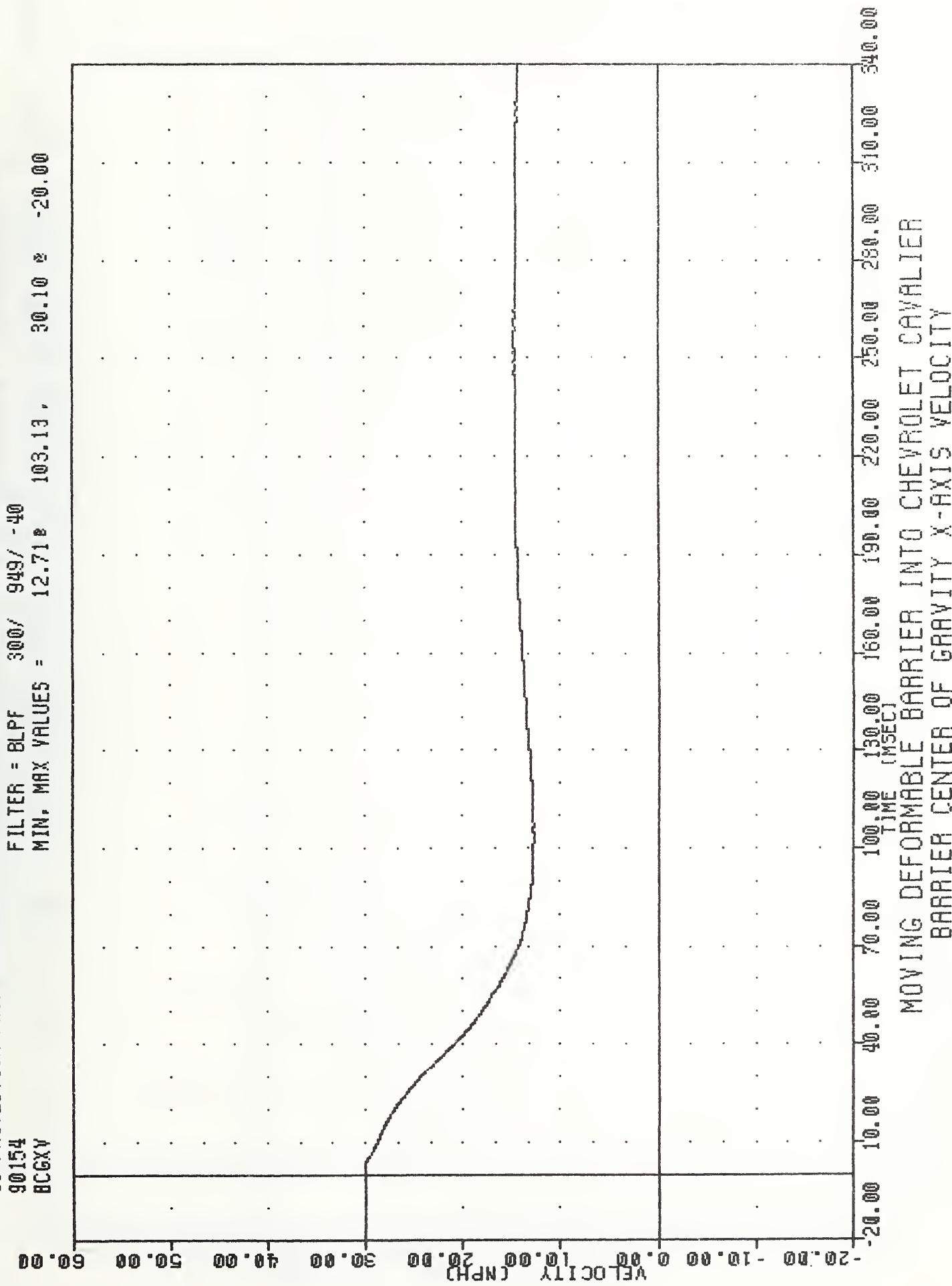


YRTC
SI PROTECTION PROD VEHICLE
90154
BCGRG

FILTER = BLPF 100/ 316/-40
MIN, MAX VALUES = 0.162 304.50 , 18.30 @ 37.13

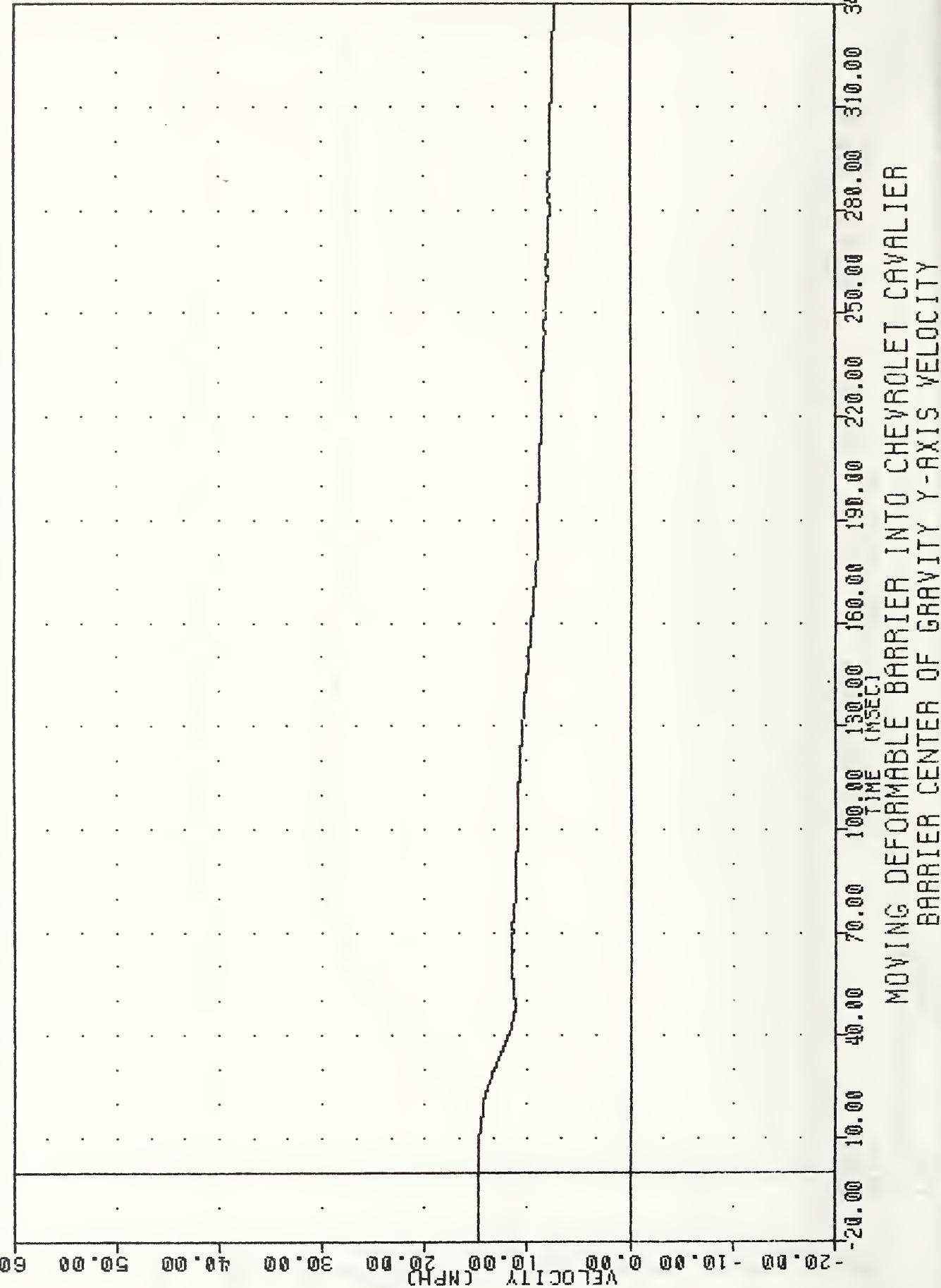


YRTC 900604
SI PROTECTION PROD VEHICLE
90154
BC6XY



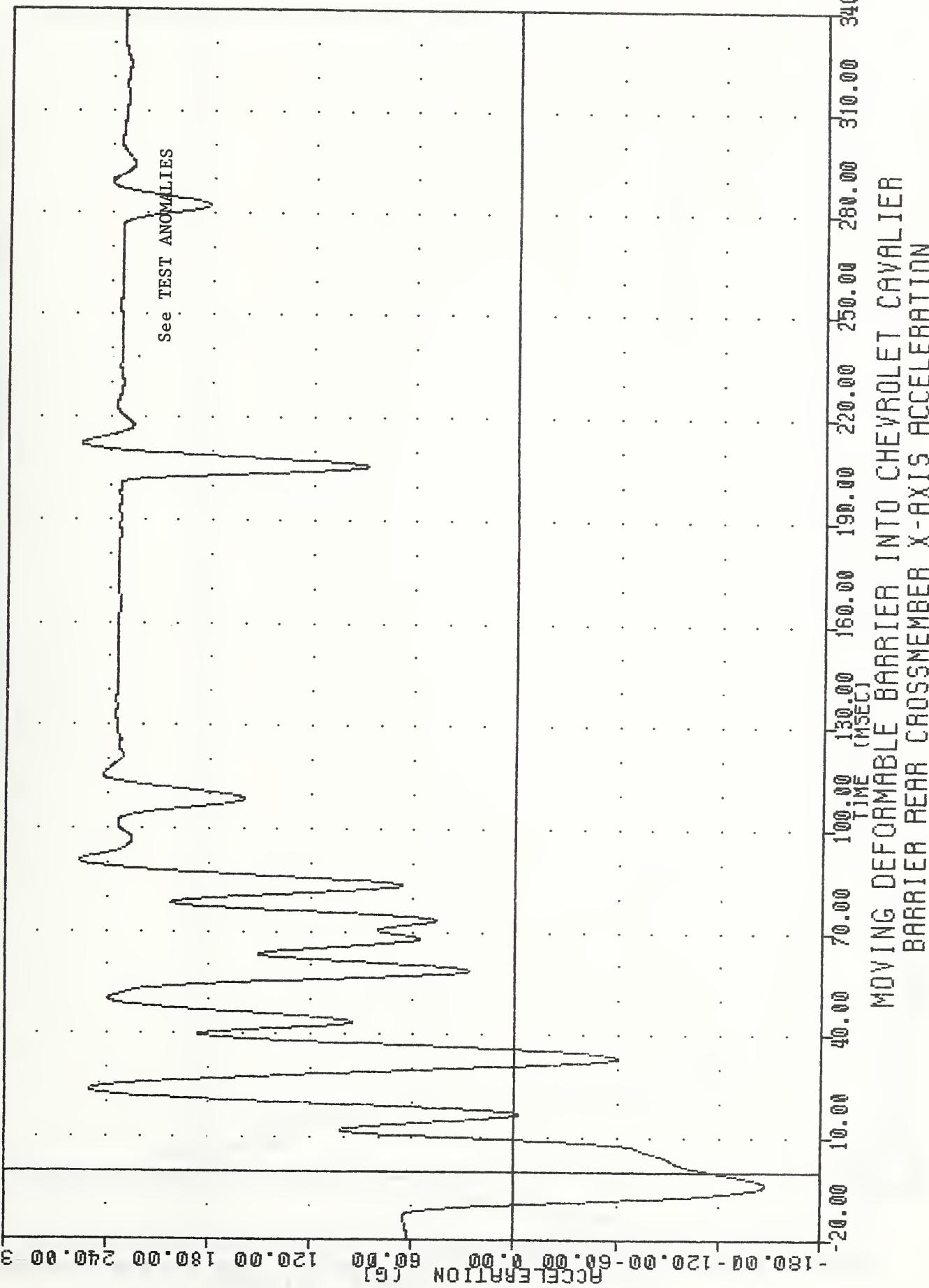
VRTC
SI PROTECTION PROD VEHICLE
90154
BC6YY

FILTER = BLPF 3000/ 949/ -40
MIN, MAX VALUES = 7.330 340.00 , 14.79 8 5.50



WRTC
SI PROTECTION PROD VEHICLE
90154
BRCKG

900604
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -147.518 -3.88 , 256.32 & 212.25

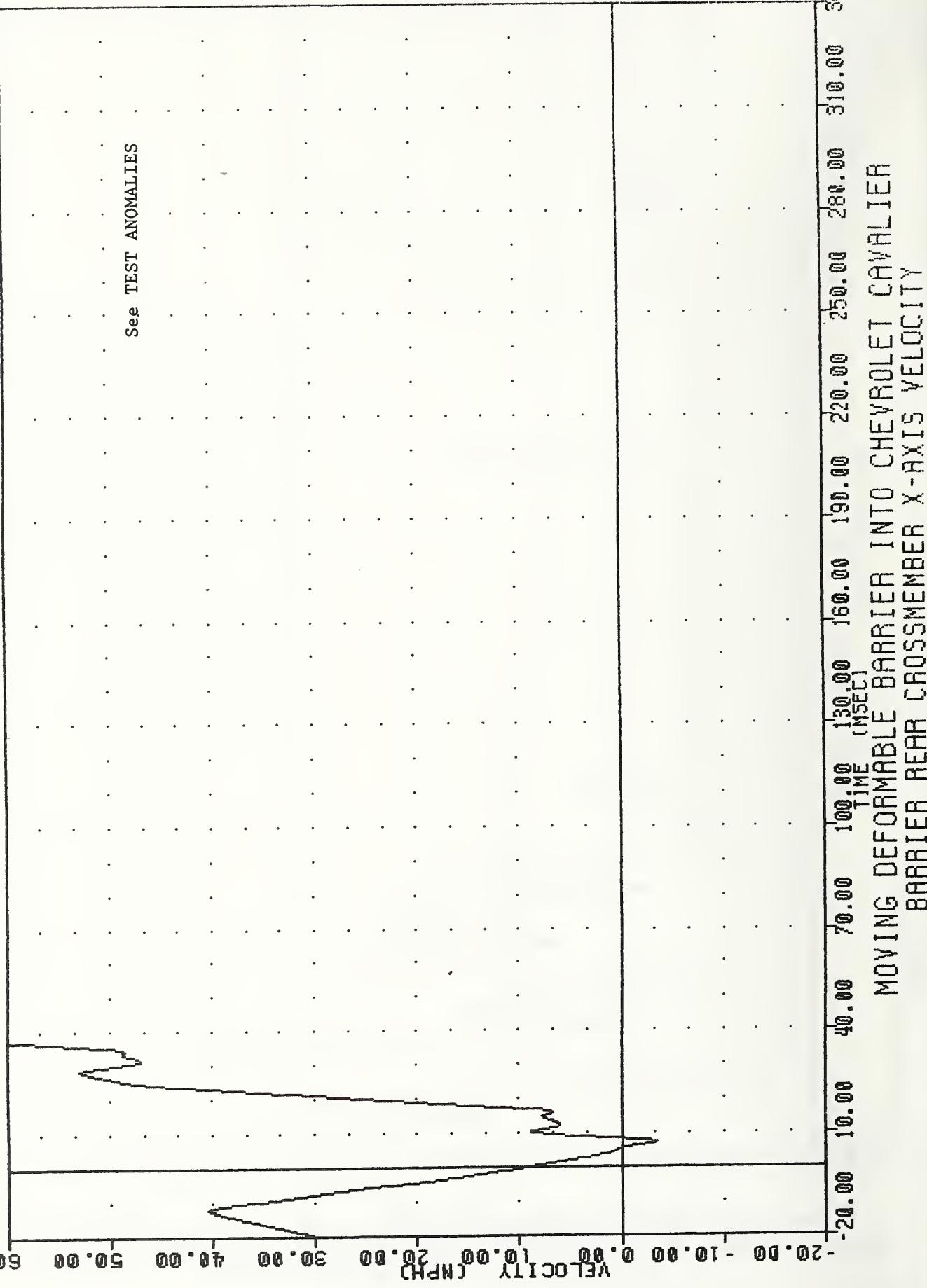


VRTC
SI PROTECTION PROD VEHICLE
90154
BRXXY

FILTER = BLPF 300/
MIN, MAX VALUES = -3.438 7.13 , 1458.84 & 340.00

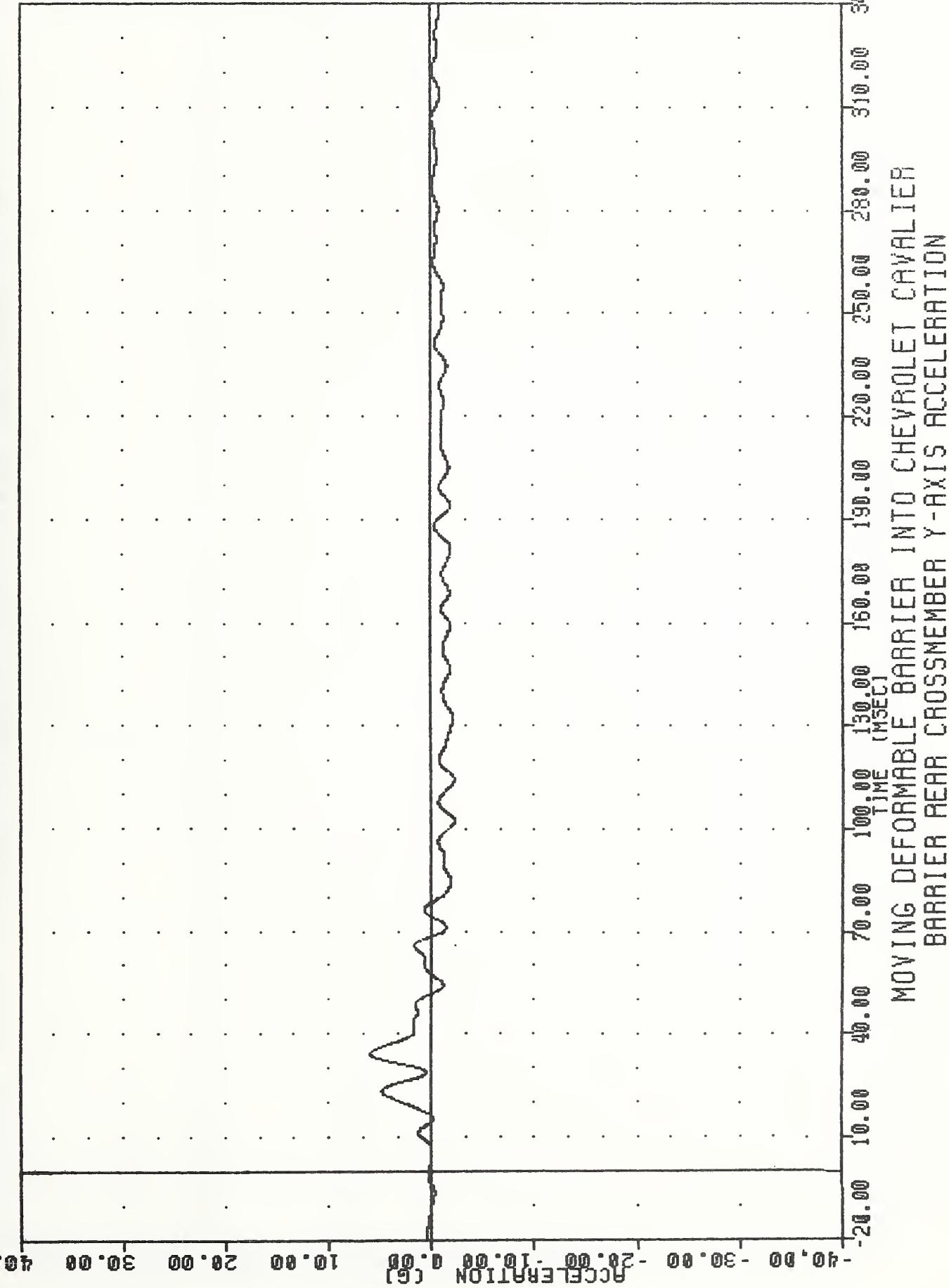
00

See TEST ANOMALIES



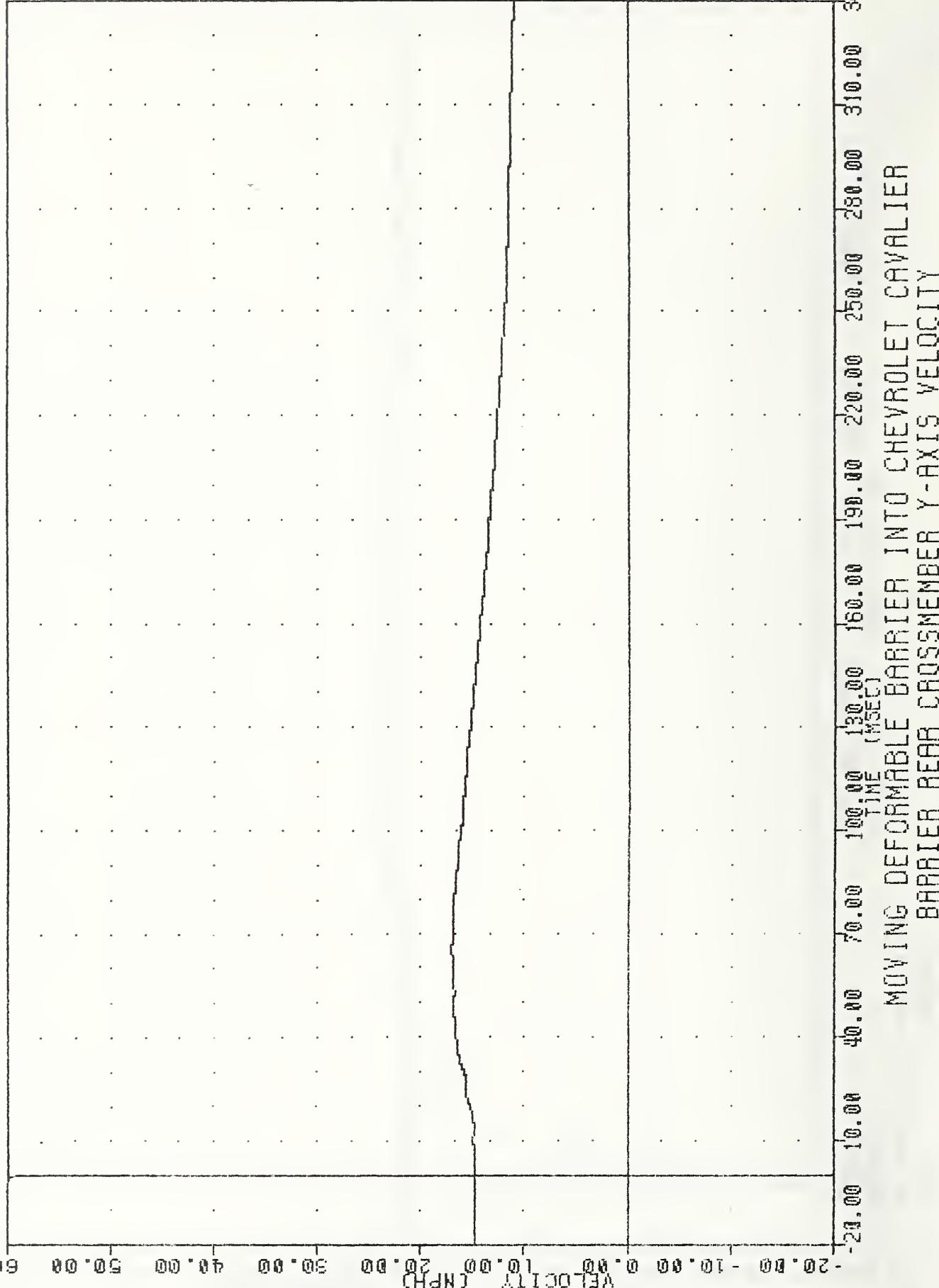
YRTC
SI PROTECTION PROD VEHICLE
90154
BRGY6

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -2.238 102.25 . 5.93 e 34.13



VRTC
SI PROTECTION PROD VEHICLE
90154
BRCTV

FILTER = BLPF 300/ 949/-40
MIN. MAX VALUES = 10.96@ 340.00 , 17.03 @ 65.13



APPENDIX C

DUMMY CERTIFICATION



DRIVER DUMMY

DUMMY NO.: 01

BIOSID CALIBRATION RESULTS

PRE-TEST CALIBRATION FOR TEST #900509

DUMMY NO. 01 SERIES NO. TRC-CAL 10 DATE 05/22/90

CALIBRATION TEST	SAE*	RESULTS
	CORRIDOR	
SHOULDER		
IMPACT FORCE (kN)	3.7 - 4.6	4.16
SHOULDER ACCEL. (g)	NA	84.1
SHOULDER DISPL. (mm)	21 - 31	25.6
THORAX - NO ARM		
IMPACT FORCE (kN)	5.4 - 6.7	5.77
UPPER RIB ACCEL. (g)	120 - 180	157.3
CENTER RIB ACCEL. (g)	120 - 180	155.1
LOWER RIB ACCEL. (g)	120 - 180	161.2
UPPER RIB DISPL. (mm)	50 - 70	60.4
CENTER RIB DISPL. (mm)	50 - 70	63.6
LOWER RIB DISPL. (mm)	50 - 70	64.0
UPPER SPINE ACCEL. (g)	16 - 24	20.4
LOWER SPINE ACCEL. (g)	11 - 17	14.5
THORAX - ARM DOWN		
IMPACT FORCE (kN)	6.2 - 7.9	6.52
SHOULDER ACCEL. (g)	NA	61.5
UPPER RIB ACCEL. (g)	52 - 78	67.9
CENTER RIB ACCEL. (g)	66 - 99	89.7
LOWER RIB ACCEL. (g)	85 - 128	114.0
SHOULDER DISPL. (mm)	17 - 27	21.5
UPPER RIB DISPL. (mm)	20 - 30	27.4
CENTER RIB DISPL. (mm)	30 - 44	37.5
LOWER RIB DISPL. (mm)	40 - 55	48.7
UPPER SPINE ACCEL. (g)	34 - 46	37.5
LOWER SPINE ACCEL. (g)	14 - 21	15.5
ABDOMEN		
IMPACT FORCE (kN)	2.9 - 3.6	3.16
UPPER ABDOMEN ACCEL. (g)	52 - 80	64.7
LOWER ABDOMEN ACCEL. (g)	55 - 87	68.8
UPPER ABDOMEN DISPL. (mm)	40 - 55	47.8
LOWER ABDOMEN DISPL. (mm)	38 - 52	41.7
UPPER SPINE ACCEL. (g)	5.4 - 8.1	6.8
LOWER SPINE ACCEL. (g)	8 - 12	9.5
PELVIS		
IMPACT FORCE (kN)	7.5 - 9.5	8.95
PELVIS ACCEL. (g)	45 - 63	50.6

*PROPOSED SAE CORRIDORS; DRAFT BIOSID USER'S MANUAL, MAY 1990.

RIGHT REAR PASSENGER DUMMY

DUMMY NO.: 02

BIOSID CALIBRATION RESULTS

PRE-TEST CALIBRATION FOR TEST #900509

DUMMY NO. 02 SERIES NO. TRC-CAL 10 DATE 05/23/90

CALIBRATION TEST	SAE*	RESULTS
	CORRIDOR	
SHOULDER		
IMPACT FORCE (kN)	3.7 - 4.6	4.06
SHOULDER ACCEL. (g)	NA	82.8
SHOULDER DISPL. (mm)	21 - 31	24.1
THORAX - NO ARM		
IMPACT FORCE (kN)	5.4 - 6.7	5.77
UPPER RIB ACCEL. (g)	120 - 180	161.4
CENTER RIB ACCEL. (g)	120 - 180	162.9
LOWER RIB ACCEL. (g)	120 - 180	162.2
UPPER RIB DISPL. (mm)	50 - 70	58.6
CENTER RIB DISPL. (mm)	50 - 70	64.7
LOWER RIB DISPL. (mm)	50 - 70	63.2
UPPER SPINE ACCEL. (g)	16 - 24	20.7
LOWER SPINE ACCEL. (g)	11 - 17	15.3
THORAX - ARM DOWN		
IMPACT FORCE (kN)	6.2 - 7.9	7.37
SHOULDER ACCEL. (g)	NA	84.0
UPPER RIB ACCEL. (g)	52 - 78	73.8
CENTER RIB ACCEL. (g)	66 - 99	92.9
LOWER RIB ACCEL. (g)	85 - 128	116.3
SHOULDER DISPL. (mm)	17 - 27	23.5
UPPER RIB DISPL. (mm)	20 - 30	23.5
CENTER RIB DISPL. (mm)	30 - 44	36.0
LOWER RIB DISPL. (mm)	40 - 55	44.0
UPPER SPINE ACCEL. (g)	34 - 46	38.8
LOWER SPINE ACCEL. (g)	14 - 21	14.0
ABDOMEN		
IMPACT FORCE (kN)	2.9 - 3.6	3.17
UPPER ABDOMEN ACCEL. (g)	52 - 80	72.9
LOWER ABDOMEN ACCEL. (g)	55 - 87	75.4
UPPER ABDOMEN DISPL. (mm)	40 - 55	45.6
LOWER ABDOMEN DISPL. (mm)	38 - 52	41.2
UPPER SPINE ACCEL. (g)	5.4 - 8.1	7.2
LOWER SPINE ACCEL. (g)	8 - 12	9.3
PELVIS		
IMPACT FORCE (kN)	7.5 - 9.5	8.57
PELVIS ACCEL. (g)	45 - 63	50.0

*PROPOSED SAE CORRIDORS; DRAFT BIOSID USER'S MANUAL, MAY 1990.

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El-Habbash,

Evaluation
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